TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

WITH

AN ABSTRACT OF THE PROCEEDINGS AT BOARD AND GENERAL MEETINGS, AND THE PREMIUMS OFFERED BY THE SOCIETY IN 1894

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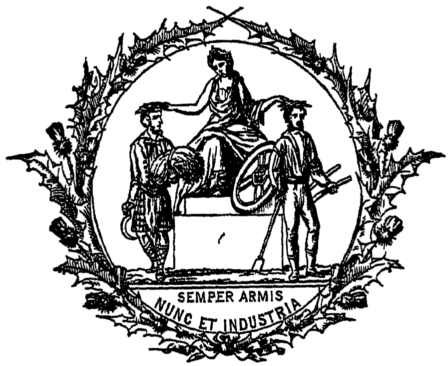

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TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

WEEDS AND WEEDING.

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PART I.—GENERAL.

SECTION I.—WHAT A WEED IS.

As a rule, a farmer grows certain definite crops upon his land. The crop produced is composed of plants desired and present by special invitation, as well as of other plants not specially invited and not specially sown. These *uninvited guests* constitute the weed part of the crop, chiefly wild plants, and it may be even cultivated plants. Potatoes left unintentionally in the soil may spring up in a succeeding crop, and, being uninvited guests there, constitute weeds: in the same way pasture grasses, however excellent, springing up in a field growing another crop are weeds.

Sometimes a farmer grows crops at random—he does not know what may result, since he is ignorant of what is sown. He sows, for example, hay-loft sweepings to produce grass crop; in such a case, where all and sundry are invited, the term "weed" is used in a peculiar sense, and not applied to uninvited guests, but merely to those components of the resultant crop which appear most worthless.

Again, when land is laid down to grass, the agriculturist often reckons upon the plants indigenous to his land. Here, as before, all and sundry are invited, and the weeds are merely the worthless components.

In true and precise farming the term weed means an uninvited occupant of the land, however good or however bad, whether desirable or not. In random farming weeds are guests —merely of a worthless kind. Writers on weeds define them variously, thus: "Every plant different from the crop and growing with the crop to its hindrance." "A plant out of place." "A useless plant."

SECTION II.—WEED DURATION.

1. *Annual Weeds.*

To the agriculturist, lease of life is one of the most important features in the natural history of any weed, since method of

destruction depends thereon. Some finish their business and exhaust themselves in a single season. Abundant flower and seed production is the conspicuous feature of these *annual weeds*, as they are called: they flower and seed once, and once only—that is the end of one generation of them.

2. *Biennial Weeds.*

These, like annuals, yield one crop of seed, and one only. The business of life is, however, not confined to one, but distributed over two seasons. During the first year these devote themselves to vegetative processes—to the manufacture of seed-making materials, which are stored away in the fleshy tap-root: during the second year, seed is produced at the expense of the stored food-stuffs, together with all the available materials contained within the plant. Exhaustion and death are the inevitable result of seed-making.

It is easy to distinguish between the storing biennial and the annual which lives from hand to mouth: only in the former is the tap-root specially thickened and fleshy. The tap-root descends vertically into the soil, and is crowned by a short stem with a rosette of leaves spread out at the surface of the ground. During the second year the bud situated at the apex of the "crown" develops aerial stem, flower, and seed: this accomplished, the plant dies.

3. *Perennial Weeds and Root-stock.*

Like biennials, these make neither flower nor seed during the first year; unlike biennials, however, they yield repeated crops of seed during succeeding seasons. To accomplish this, perennials must be provided with a perpetuating and persistent apparatus furnished with buds, and called for convenience *root-stock.*

The presence of root-stock is, indeed, a most important biological peculiarity—from root-stock new roots, new shoots, and seeded parts are produced; within it, is contained a store of root-, stem-, leaf-, flower-, and seed-making foods; by its activity the plant is propagated and multiplied. There is, accordingly, a marked difference between the multiplication of perennial and short-lived weeds. Perennials multiply in two ways—by root-stock and by seed; annuals and biennials, by seed only. From its great importance, the part of the plant called root-stock ought to be clearly distinguished by agriculturists, and not confounded with root, as is often the case; for example, the "creeping root" of couch-grass is not root, but root-stock; the "bulbs," "knots," or "pearls" of knot oat-grass are not roots, but root-stock; and so forth.

Another point of importance is the relative amount of seed produced by long-lived and short-lived plants respectively. The perennials must not exhaust themselves in seed production; if they do, perennial character is lost. Thus it happens that most pronounced perennial character is always associated with comparatively scant seed production.

4. *Tabular Statement of Weed Duration.*

With regard to duration weeds are:—

1. Annual—*e.g.*, runch, redshank.
2. Biennial—*e.g.*, spear-thistle, burdock.
3. Annual or biennial—*e.g.*, corn-flower, brome-grasses.
4. Perennial—*e.g.*, couch, coltsfoot, dock.

5. *Behaviour of Weeds when cut.*

If the stem of an annual is severed from the root the plant is killed, because the root left behind in the ground has neither buds nor apparatus capable of producing them.

A biennial may be cut in two ways—

1. Below junction of the "crown" with the tap-root.
2. Above junction of "crown" and root.

In the first case the weed is killed; in the second, an increased number of stems is developed from the cut crown left in the ground. Special care is accordingly necessary when cutting is resorted to for destruction of biennial weeds.

Cutting the perennials does not destroy and kill, but serves rather to propagate; complete removal is the only effectual killer.

Section III.—Food of Weeds.

In dealing with weeds it is of the utmost importance to understand clearly and precisely what is meant by the phrase "food of weeds." Sometimes this expression signifies the materials drawn by the plant from soil and air; sometimes the substances actually used for making root, stem, leaf, flower, fruit, and seed.

The materials drawn from soil and air are nitrates, sulphates, phosphates, water, and carbonic acid; the substances used for plant construction are not these, but starch or sugar, fat, and albumin. Thus it happens that green plants must die from sheer starvation in the richest and most fertile soil when deprived of light. Why is this? Evidently because soil and air do not directly supply food, but merely food-making constituents. It is accordingly most desirable, and indeed necessary, to distinguish—

1. *Absorbed materials* or food-making materials.
2. *Food* made from absorbed materials.

When connection between weed and soil is severed, food within the plant may be applied to seed maturation; hence annuals tending naturally to seed, especially if somewhat fleshy, such as common chickweed, should be weeded as early as possible. If they have flowered, and are allowed to lie on the land or on the dung-heap, some seed is matured and shed. Though uprooted, biennials and perennials may also mature seed when left lying on the land or thrown on the dung-heap.

Parts stored with food should always be specially noticed and specially destroyed; such are usually characterised by thickness and fleshiness. A food-storing organ other than seed indicates a lasting plant, thus—

Storing tap-root. *Biennials—e.g.*, spear-thistle.

Storing tap-root and root-stock. *Tap-rooted perennials—e.g.*, dandelions and docks.

Storing root-stock and no tap-root. *Other perennials—e.g.*, couch-grass, coltsfoot.

No one now disputes the statement that weeds utilise the same soil constituents as cultivated plants. The old argument that weeds would appear year after year on unmanured land turned over by the plough is no disproof, but serves rather to emphasise the important doctrine that certain weeds, like certain crop-plants, can prey upon undissolved soil ingredients.

Section IV.—Habits of Growth.

1. Habits of Growth of Air-Parts.—The habit of growth of a weed has much to do with the resultant injury to crop. The habit of the leafy air-parts depends chiefly upon length of stem and amount of fibrous skeleton contained therein. An elongated stem with abundance of skeleton gives a plant of *erect* habit, since the stem rises at right angles to the ground—*e.g.*, erect buttercup. When skeleton is defective, the stem either trails along the ground—the *prostrate* habit—*e.g.*, chickweed and spurrey—or rises to light and air by using a crop plant as a support. The part of the weed which attaches itself to the support may be—

1. The leaf-bearing stem. *Twiners—e.g.*, small bindweed.
2. Hooked hairs. *Hook-climbers—e.g.*, cleavers.
3. The tendrils of the leaves. *Leaf-climbers—e.g.*, hairy tare.

When the leaf-bearing stem does not elongate, the leaves are aggregated together and form a rosette apparently springing from the ground: this *contracted* habit is exemplified by coltsfoot, dandelion, daisy, ribgrass, &c.

These habits of growth may be tabulated and exemplified thus:—

1. *Erect habit*—*e.g.*, erect buttercup.
2. *Prostrate habit*—*e.g.*, common chickweed.
3. *Contracted habit*—*e.g.*, dandelion and ribgrass.
4. *Twining habit*—*e.g.*, bindweeds.
5. *Climbing habit* { with hooks—*e.g.*, cleavers.
with leaf-tendrils—*e.g.*, hairy tare.

Erect weeds occupy little space and shade crop plants comparatively little. Prostrate and contracted weeds take up much surface room.

Twiners tend to choke the crop plant used for support; removal by weeding can only be accomplished, if at all, at a very early stage. Climbers affect the support plant much in the same way as twiners: union between weed and crop plant is, however, less intimate.

2. HABITS OF GROWTH OF ROOT-STOCK.—All plants possessing root-stock are perennials: root-stock gives perennial character, and root-stock is accordingly the part to be thoroughly and completely destroyed. Habit here depends chiefly upon position with regard to the ground, length, and direction of root-stock.

Running habit is possessed by weeds with root-stock *on the surface of the ground*, elongated and horizontal; such are silverweed and running buttercup. These running weeds occur chiefly in pastures; their presence indicates that the land is in condition better fitted for weed than grass production. Since weeds of running habit are "bottom plants" or "underlings," luxuriant grass easily overshadows and ultimately starves them out.

Creeping habit is possessed by weeds with root-stock *underground*, and elongated in horizontal direction; such are corn-thistle, corn-bindweed, corn-horsetail, couch-grass, and coltsfoot. The underground character and extent of the root-stock render these weeds the most difficult to extirpate: if the land is to be at the disposal of crop, war must be waged against them. That plant is fittest for the land which has most food at command: any cause which leads to diminished supply of root-, stem-, and leaf-making substances in the weed acts unfavourably; shading and *early* removal of leaves are according extremely useful in connection with extermination of creeping plants.

Bulbous habit means that the root-stock is specially short and specially thick. The short thick "bulbs" are either solitary, as in bulbous buttercup, or clustered together like bunches of pearls, as in bulbous oat or pearl grass (*Arrhenatherum avenaceum bulbosum*). Bulb removal by mechanical processes is the best method of extermination.

Deep-rooted habit results when the root-stock is specially con-

tracted into a "crown" situated at the apex of a vertically disposed and fleshily thickened tap-root. In all other root-stock-bearing plants—running, creeping, and bulbous—the tap-root dies away. Deep-rooted perennials have the same habit of growth as biennials, namely, the fleshy tap-root and the rosette of leaves spread out upon the ground. Examples are docks, ribgrasses, and the dandelion group of composites. Examples of deep-rooted biennials are spear-thistle, burdock, and cow-parsnip. Removal of the "crown of the root" destroys biennial species. The storing tap-root which is left behind may, however, form buds and perpetuate the perennial weeds such as docks.

The habits of perennial weeds may be summed up thus:—

A. Root-stock elongated.

1. On the surface of the ground. *Running habit*—*e.g.*, silver-weed and creeping buttercup.
2. Underground. *Creeping habit*—*e.g.*, couch and coltsfoot.

B. Root-stock contracted.

1. Thick (the "bulb" or "pearl"), with fibrous roots. *Bulbous habit*—*e.g.*, bulbous buttercup and bulbous oat-grass or pearl-grass.
2. A "crown" at apex of a fleshy tap-root. *Deep-rooted habit*—*e.g.*, dock and dandelion.

3. Interference with Crops.—The five typical ways in which weeds injure crops may be tabulated thus:—

1. They diminish the cropped area—*e.g.*, ribgrass (contracted), spurrey (prostrate), silver-weed (running), couch-grass (creeping).
2. They interfere with crop-feeding—*e.g.*, annual weeds of root-crops and of beans. Interference with crop-feeding is most marked when the weed has shallow and the crop deep absorbing roots: this is the state of matters when annual weeds and root-crop grow together.
   - *a.* By appropriating food-making constituents from the soil.
   - *b.* By preventing access of light to the young crop. On "dirty land" nitrogenous applications may counteract this interference—*e.g.*, bean crop.
3. They interfere with root-breathing by preventing free access of air to the crop-roots.
4. They interfere with crop development.
   - *a.* By twining—*e.g.*, bindweeds or "tine-weeds."
   - *b.* By climbing—*e.g.*, hairy tare (fetter-weed) and cleavers.
5. They interfere with seed produce.
   - *a.* By diminishing its nutritive value—*e.g.*, wild oat.

b. By communicating poisonous properties—*e.g.*, corn-cockle.

c. By rendering it impure ("dirty seed")—*e.g.*, ribgrass.

6. They consume the crop more or less completely, and convert it into material fit only for fuel—*e.g.*, parasitic weeds (dodder, see xiv. 2).

SECTION V.—WEED MULTIPLICATION.

Weeds are multiplied in two ways—1, By propagation; 2, by reproduction.

1. PROPAGATION.—It is not the root of the weed that is the great propagator; it is the stem with its buds, bud-making propensity, and store of appropriate food. This propagator, called root-stock, is the peculiar and characteristic possession of perennial plants. Rate of propagative activity is expressed by the terms "running" and "creeping." Complete root-stock removal (removal of runners, creepers, and bulbs) is accordingly necessary not only to prevent propagation, but perpetuation as well. At times the fleshy tap-root may become a propagative organ, as in perennials of deep-rooted habit (docks, &c.).

2. REPRODUCTION.—The chief organ for weed reproduction is seed, produced, of course, in greatest abundance by plants destitute of propagating apparatus—annuals and biennials. A red poppy (*Papaver rhœas*), for example, produces twenty-five flowers, and each flower about fifty seeds. A single poppy plant is therefore capable of producing 1250 plants, assuming that all the seeds germinate; a single poppy flower allowed to mature would multiply the weed fifty-fold. The most abundant seeders are those which commence to flower early, and mature the flowers in rapid succession. The weed should therefore be taken in hand *before the first flowers form.* When pulled weeds are left on the field, the amount of food within the plant available for seed maturation must be considered. Weeding is only efficacious as a preventive when seed maturation is not accomplished: operations other than weeding are necessary when mature seeds are dealt with.

Weeds are reproduced by:—

1. Seed—*e.g.*, hairy tare.
2. Seed apparatus—*e.g.*, buttercups, runches.
3. Spore—*e.g.*, horsetail.

3. WEED REPRODUCTION BY SEED.—The seed is composed of seed-skin and baby plant or embryo. The embryo is not always sufficiently large to occupy the whole cavity within the seed-skin; in this case, the extra space is filled with a store of food for the use of the embryo during germination. This food-store is

called endosperm—not material drawn from the soil, but a product manufactured by the parent plant. It is important to distinguish the seeds wholly occupied by the embryo from those partially occupied, because size and vigour of seedling, rapidity of germination, and so forth, depend thereon. The rule is this —the larger the embryo the more vigorous is the seedling and the more rapid is the germination.

The seed is wholly occupied by the embryo, and the germination is quick and strong in the following cases:—

Cruciferous weeds—e.g., charlock, runches.
Leguminous weeds—e.g., hairy tare.
Rosaceous weeds—e.g., silver-weed.
Composite weeds—e.g., thistles, knapweeds, ox-eyes.
Labiate weeds—e.g., self-heal.

Size of seed is of considerable importance as regards ease of extermination. Small seeds can only produce a small seedling; burial at moderate depth secures destruction, because the seedling produced cannot reach the light, and must accordingly die from sheer starvation—*e.g.*, chickweed.

4. Weed Reproduction by Seed-Apparatus.—The seed-apparatus used for purposes of reproduction is composed of a single seed imprisoned in a seed-box. In this case, the part sown has an extra appliance—the seed-box—which affords extra protection to the seed. When the seed-box is specially thick, much water is required for germination; and broad-leaved plants with such seed-boxes are specially suited for wet and heavy land—*e.g.*, dock and silver-weed. On lighter lands, weeds with such appliances are more prevalent during wet seasons. The following are reproduced by seed-apparatus: buttercups, runch, silver-weed, cleavers, composites, self-heal, dock family, and grasses.

The number of seed-apparatuses produced per flower is very characteristic:—

One seed-apparatus per flower.—Composites, dock family, and grasses.
Two seed-apparatuses per flower.—Cleavers.
Four seed-apparatuses per flower.—Self-heal.
A chain of seed-apparatuses per flower.—This is a distinctive feature of true runch.
A large number of seed-apparatuses per flower.—Buttercups, silver-weed.

Discrimination between seed-apparatus and seed is easy, and of great importance in connection with seed impurities. Form of seed-box, too, is very characteristic:—

Flat seed-box—e.g., buttercups, redshank.
Triangular seed-box—e.g., sorrels, docks.

5. Reproduction by Spores.—Spore is immediately distin-

guished from seed by the absence of an embryo in its interior, by excessive minuteness and by lightness. The weeds reproduced by spores are—

Horsetail, ferns, and fog or moss.

Section VI.—Sown Weeds.

Weeds are sown in the following ways:—

1. By the weed itself—*e.g.*, chickweed and coltsfoot.
2. With the seed of the crop—*e.g.*, ribgrass with clover.
3. With dung—*e.g.*, redshank, runch.
4. With road-scrapings and composts—*e.g.*, silver-weed, docks, ribgrass, and couch.
5. By wind and animals—*e.g.*, composites.

1. The weed sows itself, unless the stem be cut, *before the first flowers form.* Coltsfoot is an exquisite example.

2. Many impurities contained in crop-seed are the reproductive organs of weeds. Seed for sowing should therefore be clean, or made so. Hay-loft sweepings are dirtiest of all.

3. Anything contained in dung capable of multiplying weeds is not dung, but *dung impurity.* This impurity may be—

1. *Living root-stocks*—*e.g.*, couch.
2. *Living seeds*—*e.g.*, charlock.
3. *Living seed-apparatus*—*e.g.*, runch.

It is easy to understand how impurities capable of multiplying plants come to be present in dung. Root-stocks and weeds are put there by the farmer's own hand. Animal dung—dung from horses, cattle, and fowls—contains many seeds and seed-apparatuses passed undigested through the alimentary canal. If animals are fed or allowed to feed on weed-seeds, such must be present in dung if precautions are not taken. "Dung impurities" are only of use to the farmer on condition that they are thoroughly decayed: then and then only are they dung. That "dung impurities" are stern realities is patent to any one—the rank vegetation growing on the dung-heap itself and the dirty dunged crops afford conclusive evidence. "It is therefore no wonder that weeding is ever doing and yet never done."

4. Road-scrapings contain the seeds of hedge and roadside weeds—*e.g.*, couch, dock, and ribgrass. These living seeds are "impurities of roadside scrapings," and do not become dung till they have been converted by a thorough process of decay. A grass crop may be seriously damaged by injudicious use of roadside scrapings.

5. Wind is at times a most important weed distributor. The seed-apparatus of most composites is provided with a crown of hairs, which allows the wind to waft from a weedy field or

hedge to a suitable germinating bed; such are thistles, dandelions, rag-weed, groundsel. Animals also distribute weeds; for example, hooked burdock-heads, the hooked seed-apparatus of cleavers, the mucilaginous seed of ribgrass, and so forth.

SECTION VII.—EXTIRPATION.

1. METHODS.—In his war against weeds the agriculturist has to make his land clean and to keep it clean. In this he is aided by natural agencies, such as frost, which kills tender weeds, and by starving birds, which pick up weed-seeds in winter and devour them as food.

Special means are also necessary to get rid of weeds. These in practice are reduced to—

A. Methods of keeping clean.

1. Prevention of reproduction by seed or spore—*e.g.*, all weeds.
2. Prevention of multiplication by root-stocks—*e.g.*, perennial weeds only.

B. Methods of making clean.

3. Prevention of growth.
4. Mechanical destruction of weeds that have grown.

2. PREVENTION OF REPRODUCTION BY SEED.—Weeds are prevented from seeding by taking them in hand *before flowering*—coltsfoot earliest of all. A cut or pulled weed may produce seed, a fact never to be forgotten when land is to be kept clean.

Everything put upon the field must be *pure*—*i.e.*, free from living seeds of weeds; the dung, the road-scrapings, the composts, the crop seed—all must be pure if weed reproduction is to be prevented. The disposal of loft-sweepings and of mill-screenings must be specially considered if pure dung is to be obtained.

3. PREVENTION OF PROPAGATION BY ROOT-STOCK.—Propagation by root-stock is to be prevented by its complete removal from the field; as before, everything applied to the land must be pure as regards living root-stocks—the dung and the compost. When dealing with couch, bent-grass, and creeping weeds in general, the purity of dung must be kept specially in view.

4. PREVENTION OF GROWTH.—Plants vary in hardihood; environment favourable to one may be inimical to another. According to the great natural law of the "survival of the fittest," weeds may be impeded in their growth and ultimately succumb if the land is so cropped and so treated that the weeds cannot hold their own. Thus it happens that certain weeds

disappear when environment is changed by draining, by tilling, by manuring, by liming, and by depasturing.

Plants that revel in moisture, such as horsetail, are destroyed by draining.

Good tillage is, in general, most favourable to the plants that have been selected for crop production.

Heinrich's experiments have shown that the tendency of mineral manures is to reduce weeds to a minimum. The following table summarises his results:—

	Percentage of weeds contained in the crop.
Undunged	53
Sulphate of ammonia	30
Nitrate of soda	26
Sulphuric acid	18
Sulphate of magnesia	10
Common salt	7
Sulphate of potash	5.5
Carbonate of lime	4.9
Quicklime	4.5
Superphosphate	4.4
Gypsum	1.9

Liming, as seen from the above table, is very prejudicial to weed life: combined with draining, it is quite a specific for sheep's sorrel.

Annuals cannot stand depasturing, which is equivalent to cutting down or leaf-removal; if such treatment is commenced sufficiently early, seeding is prevented. Troublesome annuals, such as yellow rattle, are thus readily exterminated. Depasturing, too, is very prejudicial to those perennials which spend much of their substance in the production of an underground root-stock, such as couch-grass; indeed, couch can rarely have existence in a pasture four or five years of age. Depasturing by sheep is also a specific for ragwort.

5. Mechanical Destruction.—Various mechanical processes lead to weed destruction. Ploughing cuts and buries weeds. This cutting destroys annuals and biennials, but not perennials. At the same time seeds are buried, some too deep for germination, others—especially small seeds of annuals—sufficiently deep to germinate, but not to reach the surface.

Hoeing and cultivating, rolling and harrowing, all tend much to weed destruction. Cutting, leaf-removal, hand-pulling, and gathering are also effective methods.

6. Table of Methods.—The methods by which land is made clean and kept clean may be tabulated thus:—

I. Natural extirpation.

- *a.* By heat and drought.
- *b.* By frost.
- *c.* By birds, especially in winter.

II. Prevention of seed-sowing.
- *a.* Pure dung—*e.g.*, charlock, runch, Yorkshire fog.
- *b.* Pure road-scrapings—*e.g.*, silver-weed, ribgrass, docks.
- *c.* Pure composts—*e.g.*, couch-grass and bent-grass.
- *d.* Pure crop-seed—*e.g.*, wild oat and ribgrass.
- *e.* Destruction of loft-sweepings and mill-screenings—*e.g.*, runch, bindweed, and Yorkshire fog.
- *f.* Complete crushing of weed-seeds before using them as food—*e.g.*, hairy tare.

III. Prevention of growth by modifying environment—*i.e.*, making favourable to crop and inimical to weed.
- *a.* Draining—*e.g.*, horsetail and sheep's sorrel.
- *b.* Good tillage, generally useful.
- *c.* Manuring generally useful—*e.g.*, yellow rattle and buttercups.
- *d.* Liming—*e.g.*, sheep's sorrel.
- *e.* Depasturing—*e.g.*, yellow rattle, couch-grass, and ragwort.

IV. Mechanical destruction.
- *a.* By ploughing—*e.g.*, annuals and biennials.
- *b.* By hoeing and cultivating, generally useful.
- *c.* By rolling and harrowing—*e.g.*, couch and charlock, partially.
- *d.* By cutting—*e.g.*, thistles, nettles, and ragwort.
- *e.* By early leaf-removal—*e.g.*, coltsfoot.
- *f.* By hand-pulling—*e.g.*, tap-rooted perennials, such as dock.
- *g.* By gathering—*e.g.*, bulbous oat-grass (pearl-grass).

PART II.—SPECIAL.

War against an enemy is most successful when the ways and means of the enemy are known and understood. The special descriptions which follow are intended to give this knowledge in regard to weeds.

SECTION VIII.—BUTTERCUPS OR CROWFOOTS—in meadow and pasture.

These are perennial weeds, reproduced by seed-apparatus, propagated and perpetuated by underground root-stock or by surface runners. The yellow flowers are stalked, and each produces a cluster of seed-apparatuses. A seed-apparatus—the part sown for reproduction—is composed of a single seed imprisoned in a *flat* seed-box, tipped by a projecting point—the

beak. The skin of the plant is hairy, and the leaf-surface large. The name crowfoot refers to leaf-shape; the middle toe of the foot-like leaf is longer and projects much more in the running than in the erect species. The juice is poisonous and acrid: poisonous activity, however, varies at different seasons, and is usually at maximum during flowering. The name buttercup refers to flower-colour: as animals do not browse buttercups, the flowers cannot impart yellow colour to butter. When the plants are dried and made into hay, the noxious principle is dissipated. Three species occur among grass: 1, erect buttercup; 2, running buttercup; 3, bulbous buttercup. The characters to be attended to for purposes of distinction are—1, the propagating apparatus; 2, the flower-stalk; 3, the calyx—*i.e.*, the flower-leaves external to the yellow petals.

1. ERECT BUTTERCUP (*Ranunculus acris*).—In damp meadows. The propagating apparatus takes the form of a contracted and tufted root-stock. The stem stands erect, hence the name. The primary or tap root dies away, and its place is taken by bunches of root-fibres. The underground parts are, accordingly, the contracted root-stock and the fibre roots.

The flower-stalk is round, without ribs and furrows; by this character erect buttercup may be recognised in the hay.

The seed-apparatus is leathery, brownish-yellow, $1\frac{1}{2}$-$1\frac{3}{4}$ line long, $\frac{3}{4}$ to 1 line broad, flat, and of triangular outline. The beak is short and almost straight, without curvature.

This buttercup occurs as impurity in perennial and Italian ryegrasses.

The seed-apparatus is often picked from the plant by farm poultry, and is a frequent cause of death.

2. RUNNING BUTTERCUP (*Ranunculus repens*).—In damp pasture and waste land. Instead of an underground root-stock, there is, in this case, a set of long slender runners on the surface of the ground—the apparatus for propagation, and that which gives running character. This is a surface runner, not an underground creeper like couch-grass. The runners produce buds which grow upwards, and, at the base of each bud, the root-fibres which grow downwards. An underground structure similar to that of erect buttercup would result if the runners were contracted and put underground.

The stalk of each flower shows ribs and furrows, and is not cylindrical like that of erect buttercup.

The seed-apparatus is somewhat larger; the beak is longer, one-fourth as long as the seed-box, straight or slightly curved. The most distinctive feature is the fine point-like depressions, seen by the aid of a lens. As impurity, this occurs in perennial and Italian ryegrasses.

3. BULBOUS BUTTERCUP (*Ranunculus bulbosus*).—In pasture

on light poor land. The propagating apparatus is here a single bulb-like root-stock, marked by shortness, stoutness, and solidity, technically called *corm*, not bulb: it varies from the size of a bean to that of a walnut.

The roots are fibres springing from the lower end of this "bulb" root-stock. Bulbous or knot oat-grass has a root-stock composed of clustered "bulbs," whereas in buttercup the "bulb" is solitary.

The flower-stalk is furrowed as in creeping buttercup, but the green outer part of the floral envelope—the calyx—is bent back so as to conceal the top of the flower-stalk, and by this character flower distinction is easy. The seed-apparatus scarcely occurs as impurity in commercial seed.

This is a common species in pastures, and is often supposed to give a yellow tint to butter made from the milk of cows which have eaten it. "The notion," says an old writer, "is as false as it is vulgar." "It is more probable," says another, "that the rich tint of the butter is caused by the vigorous health of the cattle when they have plenty of fresh grass and good pure air."

Section IX.—Poppies—in corn.

These are erect annual weeds, marked as annual by the primary or tap root, not specially thickened and not fleshy: propagating apparatus is, of course absent. For reproduction, an enormous number of small kidney-shaped seeds is produced; each contains a small embryo lying along the rounded edge, and an oily food mixture. The flower makes a single seed-apparatus, composed of the seed-box and the many seeds contained therein. To scatter and sow the seeds, the box opens by a ring of pore-like apertures situated immediately beneath the roof upon which the pollen has been sown. The skin of poppies is hairy, and the juice a white poisonous milk; the plants suffer little from drought. For seed germination, however, much moisture is required, and this must be taken into account if prevalence and habitat are to be understood. The noxious principle does not occur in the seed, and not in the young plant; as age advances, milky juice and poisonous activity increase, reaching maximum when fruit formation commences, and then pervading all the structures except the seed.

Three species occur among corn crops: 1, red poppy; 2, long smooth-headed poppy; 3, long rough-headed poppy. For purposes of distinction, shape and hairiness of the seed-box should be observed.

Agricultural Peculiarities.—The poppy in some seasons is one of the most troublesome weeds that occur in corn crops. It

flourishes particularly in hot and dry seasons, and gives to fields an appearance of singular beauty that may be enjoyed by all save the farmer, whose crop is ruined. It is a weed difficult to extirpate, because, though an annual, its seeds lie long in the soil without losing their vitality, and are ready to germinate whenever circumstances favour them. It is most mischievous on the poorer class of lands, not because it prefers them to the richer, but because the stronger crops on good soils overshadow it and diminish the vigour of its growth.

The seeds require abundant moisture in order to germinate successfully, hence in a wet spring, where the presence of the poppy is suspected, care should be taken to avoid harrowing the land in a wet condition; as far as possible all tillage of the surface should be done when the surface-soil is dry.

Drill-sowing of corn is to be recommended where the poppy prevails, in order to permit the crop to be well hoed.

Constant and regular hoeing, continued for some years, will gradually reduce the weed, but in wet springs it is always liable to break out again. Thorough drainage is therefore one of the necessary conditions to its complete extirpation. Liberal manuring of the land is also helpful, as the stronger crops produced tend to choke out the poppy.

The use of seed-corn free from this impurity is an essential condition to a successful war against it.

1. RED POPPY (*Papaver rhœas*).—In corn on light land. Many common names are applied to this poppy, such as field-poppy, corn-rose, &c.

It is an erect branched annual reaching 2 ft. The flower-stalk bears stiff hairs, spread at right angles to the skin—a feature quite distinctive of this species. The flowers are large, of a rich scarlet colour, with a dark eye. The seed-box is globular or top-shaped, approximately equal in length and breadth; its skin is quite bald. The seed—the part sown—is $\frac{3}{8}$ of a line in length, kidney-shaped, almost black. The seed-skin has a network of fine ridges, seen by the aid of a lens. The food in the seed for the use of the embryo is oily, and yields poppy-oil.

2. LONG SMOOTH-HEADED POPPY (*Papaver dubium*).—In corn on heavy land. The hairs on the flower-stalk are pressed down on the skin, and do not spread at right angles. The flowers are light scarlet without the dark eye. The seed-box is twice as long as broad, hence the name *long-head;* the skin of the box is destitute of hair, as indicated by the name *smooth-head.*

3. LONG-PRICKLY-HEADED POPPY (*Papaver argemone*).—In corn on light land. Among the poppies this is the weakest and the smallest. Some of its common names are—pale poppy, sand-poppy, &c. The flowers are small and pale red, with a dark eye. The coloured petals are so narrow that *they do not touch*

at the margins, whereas in other poppies the petals overlap; distinction is accordingly easy when the plant is in flower. The seed-box is elongated; the skin of the box is provided with sparse bristly hairs sloping upwards—hence the name *prickly-head*.

4. FUMITORY (*Fumaria officinalis*).—Closely allied to the poppies are the annual fumitories, readily distinguished by prostrate habit of growth, bald, often waxy skin, watery juice, and small rose-coloured flowers, with parts arranged in twos. The seed-apparatus—the part sown—contains a single seed.

Common fumitory is found everywhere on cultivated sandy fields.

SECTION X.—CRUCIFEROUS WEEDS.

These are best distinguished by the four petals of the flower arranged in the form of a Maltese cross. The part sown for reproduction is a seed discharged from a seed-box. Runch is peculiar: a pod-joint containing a seed is in this case the part sown. The seed is always completely filled by the embryo plant. The crucifers here considered are—

1. Charlocks, with yellow flowers.
2. Bitter cresses, with whitish flowers and pinnate leaves.
3. Shepherd's purse, with triangular seed-box.

1. *Charlocks*—in corn on light land.

These are tall and erect annual weeds, recognised as annual by presence of the primary or tap root, and absence of propagating apparatus. The flowers are conspicuous and yellow, each with four petals, arranged in the form of a cross—the feature characteristic of all cruciferous plants. Raceme clusters of these yellow flowers occur at the end of stem and branch. The roots harbour finger-and-toe fungus, and may spread disease to the turnips. By pulling up a few charlock weeds and examining their roots, one can immediately tell whether land is safe for turnips or not. Roughness is due to stiff hairs on the skin.

Two species are often confounded—

1. Common charlock or wild mustard.
2. Jointed charlock, runch, or wild radish.

For purposes of distinction at any stage of growth, the spread of the calyx, the colour and veins of the petals, the nature of the seed-box and of the part sown, should be observed.

AGRICULTURAL PECULIARITIES.—The charlock and the runch are in some parts of the country the most common of all weeds, and they are only less detested than some others because they

seldom entirely destroy a crop, though they frequently lessen the amount of produce by excluding light from the cultivated crops, and by utilising a great part of the ingredients in the surface-soil that would otherwise go to increase the crop produce. They also damage samples of grain very badly, and the segments into which the runch breaks cannot easily be separated in the fanners.

Both of these weeds flourish on the richer light loams and barley soils, and their occurrence in strength and abundance may usually be taken as an indication of land well tilled and in high condition. Under such circumstances it is not unusual to see fields of corn completely overshadowed for a time by the yellow flowers of these plants, which may appear in such abundance that at some little distance from the fields it is almost impossible to distinguish among them any corn.

The entire destruction of these weeds is rendered somewhat difficult because of their very extensive prevalence, and because the seeds, being well protected, retain their germinating power unimpaired after long burial in the soil. Competent observers affirm that the seeds of charlock have been known to germinate when ploughed up after they had lain forty years in the subsoil. As the seeds ripen before the corn crop is cut, many of them fall to the ground, which is thus kept seeded with them; and on land closely and constantly cropped these weeds tend to become more abundant unless special attention be paid to such means as are feasible for their destruction.

The growth of beans favours their development as much as or more than that of corn, though when the beans are drill-sown they can be destroyed in part by adequate culture. In the culture of corn crops no thoroughly effective means are available for their destruction. If the corn be drill-sown, the frequent use of the horse-hoe as long as the growth of the crop permits will tear out and destroy many of the young plants. If the crop, as is most general, be broadcast, a late and thorough harrowing of the crop, after it is seen that the weeds have well sprung up, would destroy many of them.

It is not customary to give any harrowing to corn crops after they have fairly brairded, except when grass-seeds are sown but the practice might be tried with undoubted advantage where these cruciferous weeds are abundant. The corn crops will stand a great deal of harrowing without being injured by it. When the charlock, after flowering, is seen to overtop the young corn, as not infrequently happens, the heads may be cut off all over the field with reaping-hooks or scythes. This diminishes considerably the amount of seed produced, and no material injury appears to be done to the corn.

Machines have been invented for tearing off the flowers, and

have been used to some extent in Germany, but they have not found favour in this country. In sown-out corn the seeds that fall on the surface germinate in the following spring, but the young plants are then killed either by being grazed or by being cut green; and if the field be kept for hay, the mustard and runch are unable to hold their own against the stronger growing grasses, and are killed out in the first year. When the land is ploughed again after having been some time in pasture, the seeds brought up to the surface readily germinate.

In mild districts, where the land has been ploughed up early in autumn, the seeds may germinate before winter, and in that case the young plants, being of tender and delicate character, will all succumb to the first severe frost. Those seeds that do not germinate till spring are less open to treatment till the succeeding fallow year. In the fallow year every effort should be made to free the land of the weed. This is done by constant tillage, by which successive crops of seed are brought to the surface, allowed to grow into young plants, and then destroyed by tillage before they have been able to produce seed. On the soils most favoured by these weeds, bare fallowing is never practised; but the ordinary tillage accorded to the turnip crop or to the late potato crop suffices to greatly reduce them, provided the tillage can be continued late enough in the season to prevent any of the weeds from seeding. As the runch flowers on to August or even later, this cannot always be accomplished successfully in turnip or late potato culture, and so the mischievous weed is allowed to perpetuate itself.

Perhaps it is most effectively dealt with where early potatoes are grown. During the constant tillage accorded to them, none of these weeds are allowed to attain to seed-bearing; and in the catch-crops grown after potatoes fresh successions of the plants are allowed to germinate, which are readily eaten down by sheep, and are never allowed to produce seed.

a. COMMON CHARLOCK, or WILD MUSTARD (*Sinapsis arvensis*).—In corn. This is a rough annual, reaching a height of 2 feet, with extraordinary powers of reproduction by seed, especially on light calcareous soils. The seed retains its power of germination although buried in the soil for several years. The young plant is quite harmless when eaten by stock, but becomes irritating when seed formation begins. Among its many names—all meaning a pestilent weed—are *carlock, callock, skellock, chidlack, chadlock, kedlock.*

Flowering commences in May, and continues through the summer. The flowers are conspicuous, and bright yellow, wanting the pallor of the runch. The outer part of the floral envelope—the calyx—is spread at right angles to the flower-stalk, and not erect. The seed-apparatus is a long narrow box, which

opens by two valves, to allow sowing and scattering of the seed. The seed-box is not constricted at intervals along its length as in runch. The seed is globular, black or brownish, smooth on the surface, about ¾ of a line in diameter. Within is a yellow oily embryo, tasting of mustard, completely filling the skin, and bent so as to give globular forms to the whole seed. The seeds may be used for *adulterating* feeding-stuffs, as they are not only cheap, but abundant.

b. JOINTED CHARLOCK, RUNCH, or WILD RADISH (*Raphanus raphanistrum*).—Runch is a close ally of charlock—so close that the farmer rarely distinguishes. The stem is much branched, and about 1½ foot in height. The seed retains its power of germination for a longer period, and this chiefly because of difference in the nature of the part sown. The pod or seed-apparatus does not open to allow seed escape; instead, it breaks up into joints, each containing a single seed. The part actually sown is a pod-joint containing a seed in its interior, whereas in charlock the seed alone is sown. Runch-seed, as such pod-joints are called, has thus extra protection and consequent extra longevity. The constrictions along the seed-box before it breaks up are quite characteristic: the term *jointed* refers to the presence of constrictions. The plant when eaten is very irritating, especially the seed parts.

Flowering begins in June, and may continue till September, but such late flowers cannot ripen seed.

The flower is pale-yellow, white when withered, with strongly marked *violet veins.* The calyx stands erect, and is not spread out as in charlock. The whole seed-apparatus is 1 or 1½ inch in length. When ripe the seed-box is partitioned off into a row of beadlike joints, each containing a seed. These joints fall away and reproduce the plants. They are very harmless-looking objects, like chopped straw; nevertheless, each harbours a runch-seed capable of producing a runch-plant. The seed itself is not quite globular, 1½ line long, 1 line broad, with a netted skin when examined by a lens.

2. *Bitter Cresses*—in wet pasture.

The perennial bitter cresses of wet or moist pastures are distinguished from all the other cruciferous weeds by—

1. Conspicuous white flowers, often tinged with pink.
2. Seed-box, very narrow, 1 inch or more in length.
3. Pinnate leaves—*i.e.*, the mid-rib is long, with many leaflets along its sides, and one at the end.

The perpetuating apparatus is the root-stock; the part sown, the seed. Flowering commences in spring—hence the name cuckoo-flower applied to meadow bitter cress (*Cardamine pratensis*).

3. *Shepherd's Purse* (*Capsella bursa pastoris*)—in fields on light land.

Shepherd's purse is an erect annual, and is common on fields everywhere. Though erect it is a room-demanding plant, because the stem is *contracted* at the base, and produces there a rosette of leaves spread out on the ground. The small white flowers and flat triangular pods distinguish it from all other cruciferous weeds. Shepherd's purse is liable to the same diseases as turnips and cabbages, and may communicate putrefactive mildew (*Peronospora parasitica*), as well as white rust (*Cystopus candidus*), to these plants.

Section XI.—Chickweed Family.

The distinctive features of this family are the swollen joints of the stem, and the leaves arranged in pairs. The seed-box always discharges the seeds. The embryo plant does not completely fill the seed-skin.

Those dealt with here are—

1. Chickweeds, with very small white flowers and flat leaves.
2. Spurrey, with leaves almost cylindrical, and apparently in whorls.
3. Campions, with comparatively large pink or white flowers.

1. *Chickweeds*—in root and corn crops.

These are annual weeds, marked by the small white flowers, each with five split petals, spread out like a ten-rayed star, hence the technical name *Stellaria*. In some, the most conspicuous feature is the seed-box, projecting like a tiny curved horn; these are called, accordingly, *Cerastium*. Each flower produces a single seed-apparatus, which opens by apical teeth to scatter and sow the seeds. Many seeds are produced in a single box. The seed itself is small and kidney-shaped, filled partly by the embryo plant, and partly by the mealy food mixture to be used during germination. The name chickweed indicates innocuous character, and that the plants are used as food by chickens.

Habit of growth and hair distribution are the chief points to be observed for discriminating the various species.

The chickweeds here considered are—

a. Common chickweed, with a line of hair along the stem.
b. Mouse-ear chickweed, with the whole surface hairy.

Agricultural Peculiarities.— Chickweed cannot be re-

garded as one of the most formidable weeds, but it has a very wide distribution, and is to be found on all soils and under every kind of arable cultivation. It does not come up very early in the season, hence it is essentially a weed of the root crop, as the earlier sown cereal crops keep it down. It sometimes accumulates to such an extent on the tops of potato-drills as to impede the digging of the tubers, but is chiefly injurious as it takes up much material from the soil, and excludes light and air from the roots and the lower parts of the stems of crop plants. In ordinary tillage it is rather difficult to extirpate, as it seeds very profusely at a low temperature, and produces seed when it is only a few weeks old.

✓But it may be easily exterminated by ploughing somewhat deeply with a plough provided with a skim-coulter that will pare off the surface of the soil and throw it under the furrow-slice. Its small seeds are there either incapable of germinating, or, like all small seeds, they produce thin and weak sprouts that are unable to force their way to the surface, and perish for want of air and light. It is a fresh-smelling and nutritive plant, and is readily eaten by sheep.

a. COMMON CHICKWEED (*Stellaria media*).—In fields on rich land. This is a very low annual, so low and prostrate that it does not come under the scythe. Accordingly, it rarely occurs as seed impurity. Such weeds may be called *underlings*. It is a soft juicy plant, branched and spread out on the ground, using, metaphorically considered, the fat of the land. It is distinguished from all other plants by the pecular distribution of the hair on the stems. A linear whisker runs up one side of the stem, and when a pair of leaves is reached the whisker is continued on the opposite side. No other hairs occur except those forming the fringes of the leaf-stalks. The flowers are small and white. The seed-box opens by six teeth to scatter and sow the seeds; the plant, in fact, spends itself in seed production, like all annuals.

b. MOUSE-EAR CHICKWEED (*Cerastium triviale*).—Dry fields and bare pastures. This is an annual or biennial reproduced by seed only. Its skin is covered all over with white hair—a feature which readily distinguishes mouse-ear from common chickweed. The name mouse-ear refers to shape and hairiness of leaf. The stems are branched, and tend to the prostrate habit of growth. The small white flowers are in terminal clusters of three, close together when in flower, but lax in fruit. The seed-box is *curved* like a horn, and opens by ten apical teeth to sow the tiny seeds. The curved seed-box is very noticeable and very characteristic of mouse-ear. The seeds are kidney-shaped, and occur as impurity in Alsike clover and in Timothy.

2. *Corn Spurrey* (*Spergula arvensis*)—in sandy fields.

This is a prostrate annual weed, and a typical *underling* like chickweed. It is distinguished from most weeds by the narrow almost *cylindrical* leaves clustered in whorls. The leaves of other weeds are flat structures. Small leaf surface and habit of growth fit spurrey for sandy fields.

AGRICULTURAL PECULIARITIES.—The spurrey is a succulent herb that is grown on some parts of the Continent for its herbage, but in this country is known only as an occasionally very mischievous weed. It is chiefly prevalent in sandy districts, and sometimes grows up in such profusion in a turnip-field in the early summer as to impede seriously the growth of the young turnips; while it renders the thinning of young carrots an operation of the greatest difficulty. It never does any injury to corn after lea, but corn after root-crop is sometimes completely destroyed by it, and the grazing grasses and clovers sown with the corn may be entirely smothered.

When the presence of spurrey in a fallow field is expected, the land should be worked up into fine tilth by the end of May, and should be finally harrowed smooth on the surface. In ten days the seeds of spurrey will have germinated, and the field will be covered with a mass of its small, shallow-rooted, green plants. A few turns of the harrow in dry weather will tear these out, and some days' exposure to the sun will kill them. If time permit, a second crop of spurrey may be grown and destroyed with the help of a little more field cultivation. Afterwards a quick-growing variety of turnips should be sown, and its rapid brairding should be ensured by the use of forcing manures, such as superphosphate and nitrate of soda. The after-cultivation of the turnip ought to be continued with such frequency that any remaining plants of spurrey will be torn out by the tillage implements before they flower. If even a few be allowed to nurture their seeds, they produce it in such abundance as to cause a great pollution of the field.

If the weed be not exterminated in the fallow year, it may be readily destroyed in the succeeding season by sowing out the grass-seeds without a crop. For this purpose the grass-seeds need not be sown till the end of June; and prior to that, by alternate tillage and harrowing, successive crops of spurrey-seed may have been germinated and killed out without seeding. Should any spurrey appear in the young grass, it can be extirpated by turning young cattle into the field just when the plants are coming into flower. Care must be taken to put the cattle into the field in good time; for should the seeds of the spurrey have been formed, they will be passed undigested and uninjured through the alimentary canals of the animals,

and will be quite capable of producing new crops of the weed.

3. *Campions*—in pasture and corn.

These weeds were formerly used for making the chaplets with which *champions* at public games were crowned; hence the name *campion.*

As compared with chickweeds, the flowers are large and conspicuous; the prevailing colours white or red. Some are called *catchflies*, easily distinguished from the other by the hairs on the flower-stalks, with a sticky exudate which catches flies. All are plants of erect growth—not prostrate like chickweed and spurrey.

Corn campion is the only poisonous and the only annual species. Habitat, skin, flower-colour, and calyx distinguish the different species.

The following are here considered:—

a. Bladder campion, with waxy skin.
b. White campion, with white flowers and hairy skin.
c. Red campion, with red flowers and hairy skin.
d. Ragged robin, with ragged petals.
e. Corn-cockle, with the green calyx longer than the petals.

a. Bladder Campion (*Silens inflata*).—In calcareous pastures. This is a perennial weed, reproduced by seed and perpetuated by the slender, almost woody root-stock. The skin is perfectly bald and covered with a waxy exudate, which is easily rubbed off by the fingers. There is nothing of the catchfly about this weed. The aerial stems grow in large, loose, straggling tufts. When the flower is opening, it looks like a bottle with a white neck, hence the plant is sometimes called *white bottle.* The white flowers are ¾ of an inch in diameter when fully expanded. The loose and baggy calyx (hence the epithet bladder), with a conspicuous net of veins, is quite characteristic. The seed-box is concealed within the calyx, and opens by six teeth to scatter the seeds. The seeds are kidney-shaped, almost orbicular in outline, and covered with concentric rows of small tubercles.

This campion occurs as impurity in commercial seeds of Alsike and Timothy.

b. White Campion (*Lychnis vespertina*).—In fields and on waste ground. This summer-flowering biennial or somewhat perennial weed is reproduced by seed. The whole plant is covered with soft hairs which, in the neighbourhood of the flowers, may produce slightly sticky exudate. On one plant the flowers are pollen-makers, on another seed-makers—a very characteristic feature. The large white flowers are open and scented in the evening at vesper-time: the name *vespertina*

refers to this peculiarity. The seed-box is covered by the calyx, and opens by ten apical teeth to discharge the seeds. The seeds are small, kidney-shaped, somewhat angular, and covered with small tubercles.

This occurs as impurity in commercial seed of red clover.

c. RED CAMPION (*Lychnis diurna*).—In damp pasture. This weed is very similar to white campion: it is distinguished by the red-coloured flowers, and opens in the morning.

d. RAGGED CAMPION, or RAGGED ROBIN (*Lychnis flos-cuculi*).—In moist pasture. This is distinguished from red campion by the ragged petals and the sticky hairs.

e. CORN CAMPION, or CORN-COCKLE (*Lychnis githago*).—In corn. This is a tall erect annual or biennial, reaching a height of 4 feet. The skin is covered with long, soft, white, adpressed hairs, not at all sticky. Seed germination takes place at extremely low temperature in early spring, and the plant comes into flower with the corn. At times the seed germinates in autumn, the young plant rests during winter, and renews activity in spring: in this case the plant is biennial.

Corn-cockle is harvested with the cereal—thus corn-cockle seeds and wheat grains are mixed together; if ground together the resultant flour is, of course, a mixture of both. Before grinding separation must take place, because corn-cockle seeds are very active poison. Here the poisonous principle is most abundant in the seeds, whereas in other poisonous plants, such as poppies, the seeds are quite innocuous. No poisonous seed should be used for feeding purposes, and certainly none for cake-making.

The leaves are 2 to 4 inches long, narrow, and arranged in pairs. The flowers are solitary, large, pale purple, and placed at the apex of the stem. The characteristic feature is the calyx, with long narrow green lobes *projecting beyond the coloured petals.* The seed-box contains about forty seeds, and opens by five teeth to scatter and to sow. The seeds are relatively large, 2 lines long, 1½ line broad, somewhat kidney-shaped, roundish on transverse section, with three or four angles produced by mutual pressure in the capsule. The seed-skin is black, with projecting points, and the contents are chalky white.

AGRICULTURAL PECULIARITIES.—This tall and ornamental weed occurs prominently in wheat-fields, and also flourishes among vetches. It is a very prolific seed-producer, and ripens its seed at the same time as the wheat. The seeds are separated with difficulty from the grain, and they reduce the value of the sample, as the black husks and poisonous contents, if ground with the grain, considerably injure the flour. The seed has the peculiarity of being capable of germinating at a rather low temperature, hence the weed occurs most in autumn-sown

wheat, or early sown crops in spring. When crops are sown late in spring, the young cockles having germinated earlier are killed by the tillage.

When once fairly established in a corn crop, the weed is too robust in growth to be extirpated by ordinary horse-hoeing, though its progress can to some extent be checked. The only effective means of preventing its occurrence in autumn-sown wheat is to sow seed that is quite free from it.

Section XII.—Silver-weed (*Potentilla anserina*)—in poor pastures.

This perennial is a typical roadside weed, of very running habit, and quite an underling with no aerial leafy stem. The leaves are large and very characteristic; each is composed of a long midrib, with leaflets arranged along its sides, and one at the end. Silvery appearance is due to the clothing of white hairs pressed down against the skin of the leaf. The tansy leaf is very similar, and the name *goose-tansy* has been given to silver-weed to indicate that stupid people confound it with tansy. The flower is yellow, and often confounded with that of buttercup. The part sown for reproduction is the seed-apparatus, composed of a seed-box, and a single seed imprisoned therein. The runners on the surface of the ground constitute the propagating apparatus. Silver-weed with its broad foliage must disappear when the land is brought into condition and made fit to produce luxuriant grass, sufficiently tall to overshadow the underling weed.

Section XIII.—Composite Weeds.

The composite family, marked by the presence of heads of flowers, is very large, and its members are often difficult to distinguish from one another. The following features are worthy of notice:—

1. The plants have no aerial leaf-bearing stem: *coltsfoot, daisies, dandelions.* These are accordingly *underlings.*
2. The leaves are prickly: *thistles.*
3. The leaves are remarkably large, and the heads take the form of burs: *burdocks.*
4. The heads are hard, large, and knob-like; *knap-weeds* or *hard-heads.*
5. Chaffy scales occur among the flowers: *true chamomiles, cat's-ears.*
6. Milky juice is present: *sow-thistles, dandelions,* and *nipple-wort.*

Each flower of a head produces a seed-apparatus, composed of a seed-box in which a single seed is imprisoned. The seed-box is crowned by a tuft of hairs for securing wind-sowing. In the following cases the hair crown is absent: ox-eyes, daisies, chamomiles, and nipplewort.

The groups of composites here considered are—

1. Thistles, including sow-thistles, with prickly leaves.
2. Burdocks, with large leaves and bur-heads.
3. Knapweeds, with hard globular heads, dark externally.
4. Ox-eyes, leaves not dissected. } No hair crown.
5. Daisies, no aerial leafy stem. } No hair crown.
6. Chamomiles, leaves dissected. } No hair crown.
7. Coltsfoot, no aerial leafy stem; leaf shaped like a horse's foot.
8. Ragweeds, erect weeds, with ragged leaves and yellow heads.
9. Composites with milky juice—dandelions, nipplewort.

1. *Thistles.*

These are composite weeds, marked such by the heads of flowers, and distinguished by the prickly leaves.

There are two groups of thistles—

1. *Thistles proper*, with watery juice and purple flowers.
2. *Sow-thistles*, with white milky juice and yellow flowers.

Each flower of a head produces one seed-apparatus, composed of—

1. Seed-box.
2. The single seed imprisoned therein.
3. The tuft or crown of "thistle-down" fixed to the apex of the seed-box.

A seed-apparatus constructed thus rarely occurs as impurity, because natural wind and wind from fanners blows most of it away. The seed-skin is completely filled by the embryo plant, as in all composites—that is to say, fullest maturity is attained by the baby plant before detachment from the parent occurs.

The thistles here dealt with are—

Purple-heads. { *a.* Corn-thistle, stem without prickly wings.
b. Spear-thistle, stem with prickly wings.

Yellow-heads. { *c.* Common sow-thistle, small heads.
d. Corn sow-thistle, large heads, clothed externally with sticky hairs.

a. Corn-Thistle, or Creeping Thistle (*Carduus arvensis*).—This weed is perennial, reproduced by the seed-apparatus, and propagated by the deep and creeping root-stock.

The seed-apparatus is sown by wind, and the special structure which enables the wind to act as a sower is the crown of thistle-

down on the seed-box. When carefully examined this down is easily seen to be composed of feather-like hairs.

The deep root-stock extends itself horizontally through the soil—"creeps," as the saying is—and as it goes sends shoots up into the air and roots down into the ground. A tiny piece of it contains all the stuffs requisite for the production of a thistle. Having this peculiarity, the root-stock must be reckoned with when eradication is attempted.

The aerial stem is tall, reaching at times 4 feet, erect, scarcely branched, and destitute of prickly wings. The leaves have the prickly margins characteristic of thistles, but they do not run down the stem, hence absence of prickly wings. The purple flowers are aggregated into fairly large heads.

On one plant the heads produce pollen only, on another seeds only: this thistle, accordingly, carries the principle of division of labour to great perfection. The pollen-making plants have the heads of flowers much more conspicuous than the seed-making, and this because insects are required for sowing the pollen. The seed-apparatus has a crown of feathery down about 1 inch long. The seed-box itself is 1½ line long, ½ line in diameter, dark-brown, smooth-skinned, and triangular in transverse section.

Agricultural Peculiarities.—The common field-thistle is one of the most widely-spread weeds, and one of the most universally troublesome. It is not, however, indifferent to soil, but has a distinct preference for good loams, and flourishes best on those that are fairly supplied with organic matter, and that are rich in lime. In the absence of these favouring conditions the thistle still grows in undiminished numbers, but the strength and vigour of the plants is markedly diminished. It spreads rapidly and over extensive areas by means of its abundant feathery seed-vessels, which are blown freely to great distances by the wind; and every bare spot of earth that is unprotected by a surface-covering of other plants becomes quickly planted with thistles. A piece of ground on the side of a hill at a moderate altitude, if bared of its turf, soon becomes so thickly planted as to appear a veritable thistle plantation.

When once established in any place the thistle maintains itself securely, by means of its deep and persistent root-stock, against all attempts to destroy it. On good soil, with a moderately open subsoil, the root-stocks will penetrate to a depth of more than 3 feet, and have been known to force their way into drains and choke them. They are, on this account, so largely subsoil-feeders, that they do not compete with crops to such an extent as many other weeds for the food on the surface-soil; and they have been even grown in Australia to bring up food

from the subsoil, which was utilised for the enrichment of the surface-soil, by ploughing them in.

Their presence in crops of corn is, however, found very objectionable, as their prickly stems growing up in the straw render the handling and binding at harvest a matter of great difficulty to the workers. The use of self-binding reapers, now rapidly extending, overcomes this difficulty in great measure; but the entire removal of thistles from our corn crops remains no less necessary, as the only means available in these crops of preventing their coming to seed.

The prevention of seeding is a matter of the greatest importance in dealing with the thistle, because of the manner in which the seeds are spread abroad by the wind. Seeding is prevented on root crops during the ordinary processes of tillage, and on pasture-fields, by cutting down all the plants before the seed is developed. In ordinary farm practice this operation is unfortunately very frequently done too late, through farmers not being aware of the fact that some time before complete maturity of the seeds has been attained, the thistle contains a sufficiency of nutritive material to ripen the seeds perfectly after the stems have been cut down.

In corn crops the cutting of the thistles is impossible, and there is no other means of dealing with them than that of pulling them up by hand. This can only be effectively done after the ground has been softened by rain; and in dry seasons it is often impossible on hard soils to do it perfectly. The operation should be done as late in the summer as it is possible to enter into the corn-fields, in order that the younger thistles may not be passed over, as they are likely to be, if the operation be attempted too soon.

The diminution of the thistles, by preventing them from seeding, is in general found to be a comparatively ineffective measure, chiefly because it is not done with sufficient thoroughness. While the thistles in arable fields are cut down, those on hills and permanent pastures are too often left untouched; while those growing in the fences at the sides of plantations, as well as of arable fields, are left to produce their winged seeds in undisturbed security. It is because of this culpable neglect of fence weeds that thistles are found to be more prevalent in districts of small farms than where the farms are larger and the fences fewer. The complete extirpation of the thistles cannot, however, be effected by a mere prevention of seeding, but must be accomplished by the destruction of the root-stocks. This is not easily effected on account of their deeply penetrating habit. Ordinary shallow ploughing is of no effect except to increase their numbers, as the roots cut into pieces near the surface by the plough merely send up multiplied stems.

The pulling up of the plants by the roots is effective, but can only be accomplished with some effect in the corn crops where the land has been softened by ploughing and tillage, and cannot be done on grass-land, as the brittle roots will break near the surface and send up fresh stems. The cutting off of the heads after flowering prevents seeding, but at the same time rather tends to strengthen the roots by preventing the exhaustion that attends the formation of seed; while, on the other hand, the cutting is too late to deprive the root-stock of the supplies of food drawn from the stem and leaves. But the constant and repeated cutting of the young stems as soon as they appear above ground will weaken the root-stocks, and if steadily persisted in will ultimately starve them out.

√The growth of crops that are constantly tilled through the summer is, therefore, very inimical to the welfare of the thistle. The growth of various deep-rooting crops, such as rape, sainfoin, or lucerne, is also injurious to them, as they compete effectively with the thistle for its supplies of subsoil food and tend to starve it out. Deep ploughing also destroys many; and the operations of bare fallowing are also useful, provided the roots brought to the surface are collected and removed. Their mere exposure in part to the action of heat and drought is not to be relied on.

The sow-thistle, which frequently accompanies the field-thistle in corn-fields, is more easily extirpated. The tillage of the fallow year, whether bare or cropped, kills it out, and it disappears entirely on land laid down to grass for some years.

b. Spear-Thistle (*Carduus lanceolatus*).—In waste ground and fields. This is a biennial weed, marked during first year by the long fleshy tap-root, crowned by the contracted stem bearing a rosette of leaves spread out on the surface of the ground. At this stage the plant is an *underling*. During second year an erect leaf- and flower-bearing aerial stem is produced. The leaves run down the sides of this stem and cover it with prickly wings. The heads of flowers are also prickly externally, egg-shaped, stout, and large—about 1½ inch long when in flower. The plant is prickly all over, hence the name spear-thistle.

c. Common Sow-Thistle (*Sonchus oleraceus*).—In corn. This erect annual species is reproduced by the seed-apparatus, and destitute of organs for propagation.

The skin of the plant is bald, but at times a few straggling hairs may be present. The stem branches freely and rises to a height of 2 or 3 feet. The upper leaves are seated directly upon the stem, without intervention of stalk or petiole. The leaf-base has a characteristic pair of ears clasping the stem; these are pointed and horizontal, not rounded and vertical. The ends of stem and branches are occupied by loose clusters of flower-

heads: the plant being an annual, has to spend itself in seed production. The heads are pale yellow and small in size—half an inch or so in diameter—when in full bloom.

d. Corn Sow-Thistle (*Sonchus arvensis*).—In corn. This is a perennial, reproduced by seed-apparatus, and propagated by root-stock, which creeps extensively, and is freely branched. Common sow-thistle has no propagating apparatus and no root-stock. The skin, especially in the neighbourhood of the flower-heads, is clothed with dark hair exuding sticky matter. The aerial stem is simple, not branched. The ears of the leaves are not pointed but rounded, not spread horizontally but erect and pressed up against the stem.

Here seed amount is of less import, and a single set of terminal heads suffices. Bright yellow colour and large size—1 inch or more in diameter when in flower—are distinctive features. The annual species is in fruit when the perennial is coming into flower.

2. *Burdock* (*Arctium lappa*)—on waste ground.

Among composites this erect biennial weed is easily distinguished by—

1. The large broad leaves.
2. The bur-heads.

The agriculturist frequently associates the name dock with large broad leaf, and, in the same way, the name grass with small narrow leaf. Confusion with thistles is impossible, since the leaves are not prickly. The heads are invested by a set of hooks which adhere to passing animals, particularly to wool; hence the name *bur*. The scattering of burdock is thus secured by animals, whereas other composites, like thistles, are spread by wind. During first year the plant is an underling, with rosette of leaves spread on the ground; during second year the erect aerial leafy stem and the bur-heads are produced: the plant is now exhausted.

3. *Knapweeds.*

These are erect composites, marked such by the heads of flowers. The name knapweed, indeed, refers to the presence of the hard, stout, and globular heads, each like a round knap or knob at the end of a walking-stick. The external part of the head is formed by a set of dark-coloured overlapping leaves, fringed with teeth, and not prickly like the corresponding parts of the thistle-head. Knapweeds are never prickly, and by this character they are immediately distinguished from thistles. Like thistles, however, they have watery juice and purple flowers.

Two species are considered—

a. Corn knapweed or corn-flower, with blue flowers.

b. Black knapweed or hard-head, with purple flowers.

a. Corn-flower or Blue-bottle (*Centaurea cyanus*).—In corn. This is annual or biennial, reproduced by the seed-apparatus only. The seed-apparatus is composed of a single seed imprisoned in a seed-box, crowned with stiff hairs, not with soft down as in thistles. Germination takes place in spring or in autumn; in the former case the plant is annual, in the latter somewhat biennial. The stem is 1 to 3 feet high, branched, erect, and so abundantly provided with fibrous skeleton that it is called *hurtsickle.* The leaves are very narrow, and lance-shaped. The flowers are aggregated into heads, placed singly at the ends of stem and branch. When the blue flowers are peeping out, the head looks like a bottle with a blue neck, hence the name *blue-bottle.* When fully expanded the blue flowers spread out over the knob like a bonnet over a head, hence the name *blue bonnet.* The seed-apparatus is whitish, like glossy parchment, 1½ line long, ¾ line broad, the upper end blunt and broad, and the lower narrow. The hair-crown is composed of stiff tawny hairs, almost as long as the seed-box.

This is a rare impurity in cereal seed, but often occurs in dung, because the flower-heads and the seed-apparatuses which they contain remain in the straw.

Agricultural Peculiarities.—The corn-flower is most prominently seen in corn after grass, and, as it is a biennial, its appearance in corn after fallow can only be attributed to careless and insufficient cleaning of the land during the fallow year. In the numerous tillage operations of that year the roots of all biennial weeds should be so completely cleared away that there can be no development of seed in the succeeding season. The weed is kept on the land, however, in part, because its heads remain mingled with the straw of the corn crop, and are liable to be returned to the fields in the farmyard manure.

If the corn crop be autumn-sown and drilled, repeated horse-hoeing will help to destroy the weed, and by careful and thorough cleaning of the land, and the use of pure seed, it may be pretty thoroughly extirpated.

b. Hard-head or Black Knapweed (*Centaurea nigra*).—In hay and by roadsides. This perennial weed is reproduced by the seed-apparatus, and propagated by the short oblique root-stock. The skin of the plant is rough, with short stiff hairs. The stem is erect, rising to a height of 2 feet or more, very tough from abundance of fibrous skeleton, and rather difficult to cut. The flower-heads are very hard, black externally, ter-

minating stem and branch. The flowers are purple-coloured like those of thistles.

Though a frequent component of meadow-hay, the seed-apparatus of this plant rarely occurs as impurity in commercial seed.

4. *Ox-eyes.*

The large daisy-like heads mark this group of composite weeds. The leaves are not finely divided—not dissected into fine segments as in the chamomile group. The head has a flat yellow eye of tubular flowers, surrounded by a ray of strap-shaped flowers. The seed-apparatus—the part sown—is composed of a seed imprisoned in an elongated seed-box, with prominent ribs on its surface: there is here no crown of hairs on the seed-box.

Two species are considered:—

a. Yellow ox-eye.
b. White ox-eye.

The colour of the ray suffices to discriminate the two species.

a. YELLOW OX-EYE or CORN MARIGOLD (*Chrysanthemum segetum*).—In corn. This is an annual reproduced by the seed-apparatus, and destitute of organs of propagation. The seed-apparatus is sown for purposes of reproduction, and though buried in the ground for several years the power of germination is retained—hence its prevalence in lea corn. The skin of the plant is bald and *waxy*—a sign of hardihood: drought, for example, affects the plant but little. The stem is erect, 12 to 18 inches high, and branched. The flowers are in heads, 1½ to 2½ inches across, placed singly at the ends of stem and branch. In the common ox-eye the peripheral flowers of the head are white, whereas in yellow ox-eye the whole head is bright yellow.

Two kinds of seed-apparatus are produced by each and every mature head:—

1. The winged form, developed from the ray flowers.
2. The wingless form, developed from the eye flowers.

Both forms are brownish and ribbed. The wing is an outgrowth of the seed-box, which secures lightness and facilitates sowing by the wind.

AGRICULTURAL PECULIARITIES.—This annual weed is of somewhat irregular occurrence, being exceedingly common in some districts of the country, and totally unknown in others. This is probably due to the fact that it seeds so abundantly, and its seeds spread so easily, that when once it has obtained a footing in any locality, it spreads till it seems to usurp every spare section of corn-land. It is to be found alike in corn after lea or after roots, and though it does no specially characteristic

injury to the crop, it tends to diminish the yield by taking food and air that would otherwise be at the disposal of the corn. It is difficult to get rid of, because the seeds blow readily from field to field and from farm to farm, so that one careless farmer in a locality will be the means of readily infecting all his neighbours.

The seeds also retain their germinating power for a long time, and hence the occurrence of a fallow year, during which the plants can be prevented from seeding, does not suffice to kill them out. If, however, no plants are allowed to seed during the fallow year, and if during the growth of the next corn crop all the remaining plants be pulled up by hand before seeding, then the weed may be completely exterminated, provided no new supply of seed is blown over from some adjacent field.

b. WHITE OX-EYE or MARGUERITE (*Chrysanthemum leucanthemum*).—In dry, poor pastures. This is a perennial weed, with watery juice, reproduced by the seed-apparatus, and propagated by the root-stock, which is slender, woody, and branched. The skin is usually bald, but sometimes downy. The plant is readily recognised by the large solitary heads of flowers, similar to daisy heads, but 1½ or 2 inches across. The leaves are not divided into fine segments like those of scentless mayweed (*Matricaria inodora*). The seed-box is dark grey, with very prominent ribs, about three times longer than broad.

This composite weed occurs as impurity in grass-seeds—*e.g.*, Italian, cocksfoot, &c.

5. *Common Daisy* (*Bellis perennis*)—in poor pastures.

Common daisy is an underling immediately distinguished from ox-eyes by absence of leafy aerial stem. The leaves are arranged in rosettes spread on the ground and springing from the tufted root-stock. The flower-head is small as compared with that of ox-eyes; the eye is yellow and the surrounding ray white. The seed-apparatus is constructed on the same principle as that of ox-eyes. An underling like this requires free access of light, and if crop is luxuriant the daisies must yield. Abundance of such weeds, accordingly, indicates poverty of land—land incompetent to yield large crops.

6. *Chamomiles* or *Horse-gowans*—in corn and on waste land.

These are annual weeds. The flower-heads, like those of white ox-eye, have a yellow eye surrounded by a white ray: the very prominent eye and the dissected leaves readily distinguish. The seed-apparatus is constructed like that of ox-eyes, and

does not occur in corn because it is light and easily blown out by the fanners.

The species here considered are—

a. Corn chamomile, with chaff among the flowers; scented when bruised.

b. Scentless chamomile, no chaff among the flowers; scentless when bruised.

a. Corn Chamomile (*Anthemis arvensis*).—This erect weed is reproduced by the seed-apparatus, and being annual, is destitute of perpetuating organs. When the flowers are pulled out of the head, chaffy scales are found mixed among them: there is no chaff among the flowers of scentless mayweed. The skin is so downy that the plant has quite a hoary appearance.

Not so stinking chamomile (*Anthemis cotula*), also growing among corn: in this case the skin is quite bald, and the green colour shows up strongly. The name stinking refers to the very strong scent given off from the leaves when bruised.

b. Corn Feverfew or Scentless Mayweed (*Matricaria inodora*).—In corn crops and on waste land. This common annual weed is erect and bald-skinned. The leaves are scentless when bruised, and there is no chaff between the flowers. These characters suffice to distinguish from true chamomiles.

Curative action has given rise to the name *feverfew.*

7. *Coltsfoot* (*Tussilago farfara*)—moist ground, especially if calcareous.

This very early flowering perennial weed is reproduced by the seed-apparatus, and propagated by the root-stock. The seed-apparatus is composed of—1, a seed; 2, a seed-box; 3, a crown of downy hairs. The root-stock is elongated, freely branched, extensively creeping, and remarkably slow to undergo decay: when buried too deeply it may remain dormant for a long period, and if brought again to the surface vital activity is renewed.

From the root-stock tufts of unbranched scaly stems, 6 to 8 inches high, and destitute of green leaves, are sent up in *spring.* These are the flower-bearing stems, and each terminates in a single head of yellow flowers. As yet no green leaves are produced—a very remarkable and distinctive feature, inasmuch as ordinary plants either make leaf and flower together, or leaf first and flower afterwards. Coltsfoot, however, is in haste to sow itself in the early part of the year, when land is most unoccupied; the high winds usually prevalent at this season effect the sowing. A plant can only proceed to business in this fashion on condition that a store of food material accumulated during

previous years is available; this feature of coltsfoot accordingly marks perennial character.

The green leaves are produced by underground branches of the root-stock, and are arranged in tufts at the ground. The plant is an underling, destitute of aerial leafy stem. Large size, 4 to 10 inches broad, shape like a coltsfoot, and the under-surface with a blanket of white down, are the characteristic leaf-features. Leaf-shape has given rise to many names: *asses-foot, bulls-foot, horse-hoof.* Medicinal use has given origin to the name *coughwort.*

The juice of the plant is watery, not milky. The seed-apparatus—the part sown for reproduction—is pale brown, angular, not flat, with a crown of white hairs three times as long as the seed-box.

As a seed impurity this does not occur because of low stature, early ripening, and wind-scattering.

The special necessaries for coltsfoot growth are—1, abundant water in soil; 2, free access and utilisation of light. The plant must disappear whenever these conditions cease to be fulfilled.

Agricultural Peculiarities.—This unpopular weed, which has no beauty to compensate for its hurtfulness, is especially an inhabitant of stiff clay soils, and more particularly of those that are marly in character, abundant lime in the soil being favourable to it. It is found in its most flourishing condition on the wetter parts of the clays, and its creeping root-stock extends itself with great rapidity through the soil, and is very tenacious of life.

It is a very injurious weed, as not only do its root-stocks monopolise a large area of the soil to the exclusion of better plants, but its broad-spreading leaves cover a great part of the surface, exclude light, and prevent the proper spreading and tillering of the young wheat and other plants. It is rendered somewhat hard to destroy because its seeds are shed in the early season before their presence is even suspected, and because of the vitality of the root-stock. On the stiffer clays, on which it is most prevalent, it is hardly possible by any ordinary means of tillage to remove its underground stems from the ground without leaving some fragments behind. But every little fragment of the root-stock torn off and left in the soil retains its vitality, and is capable of producing a new plant. The absolute removal of the plant from the soil by cleaning, though not quite impossible, is therefore a matter of great difficulty, and requires a more exact and more expensive labour than a farmer is usually willing to accord.

Ordinary shallow tillage operations, even if accompanied by a moderate amount of cleaning, do it little harm; for what it loses by removal of some stems, it gains by the more favourable

condition of the soil, after tillage and cleaning, for the growth of the plants remaining. A very deep ploughing will, however, in many cases greatly reduce it, and if that be given during a dry summer fallow, and especially if the surface has been previously pared and burned in the spring before seeding, the coltsfoot may be almost entirely extirpated.

The first step, however, and the most essential for the destruction of the weed, is to thoroughly drain all wet parts of the land. It is essentially a plant of wet soil, and if that condition be removed the weed is greatly weakened. Draining followed by a deep ploughing will seldom fail to greatly reduce it. Any method of ameliorating the texture of stiff soils and rendering them more friable is also beneficial. Such are the application of ashes, of sand, or of farmyard manure, and the growth of large crops.

Even shallow tillage may be useful if done in the spring when the plant is producing its flowers, as a means of preventing the seeding. By neglect of this preliminary operation many vigorous efforts at cleaning during the summer fallow are rendered of no effect; and the farmer who has expended much labour in clearing out all the root-stocks from the ground is amazed to find the weed growing as freely as ever in the succeeding season, not knowing that a fresh stock of seed had been sown before his cleaning began, and that he had merely been repeating the old and familiar operation of locking his stable-door after the steed was stolen. Constant and regular cutting of the leaves and flowers in an immature condition will weaken the plant and prevent the extension of its underground stems, and such means, if steadily persevered in, will ultimately wear them out, and cause death from want of food.

8. *Ragweed* or *Ragwort* (*Senecio Jacobea*)—in pasture.

This tall, erect, bald-skinned perennial is reproduced by the seed-apparatus, and perpetuated by the root-stock which crowns the fleshy tap-root. The seed-apparatus—the part sown—is composed of: 1, a seed; 2, a cylindrical seed-box; 3, a crown of long grey hairs. The grey hairs are much in evidence at seed-time, hence the generic name *Senecio,* from *senex,* old. The stem and its apical branches are terminated by clusters of yellow flower-heads. Each head when fully expanded is almost an inch in diameter; eye and ray are golden yellow. The green leaves are curly like parsley, glossy, and much cut—hence the name *ragweed.*

This is frequent in grass, but being wind-sown does not occur as seed impurity.

Agricultural Peculiarities.—This weed occurs most abundantly on pastures, and especially favours the lighter and medium class of soils, provided they be sufficiently dry. It seeds freely; and as the seed-vessels are provided with tufts of hair, they are readily carried by the wind, and thus the weed is spread abroad. In warm climates the seeds ripen early enough in summer to germinate again before the autumn, and the young plants thus produced are able to stand the frosts of winter, and are ready to grow up vigorously in the following summer.

The spreading of the seed can be checked by cutting down the plant in time to prevent seeding, but this does not destroy the plant, as its tap-root is perennial. Ragwort may, however, be readily extirpated by pulling up the roots when the land is softened by rain. This cannot be very effectively done in summer, when the roots are soft and full of vitality. The best method is, when cutting off the heads, to leave a sufficient length of the lower part of the stem untouched. In the autumn, when the ground has been softened by rain and the roots have shrunk and hardened, they may be quite easily pulled out by hand.

The simplest means of exterminating the ragwort is, however, to graze the land with sheep in the early summer. Cattle will not touch the weed at any stage of its growth; and sheep do not readily eat its stems when well matured, but they greedily eat its young leaves on their first appearance in spring, and on land regularly stocked with sheep not a single ragwort can be seen. The ragwort is also to be found in corn crops, but not to such a degree as to do any serious damage.

Groundsel (*Senecio vulgaris*).—In fields. Groundsel is an annual, so to speak, a diminutive ragweed, much more juicy and less fibrous, living on richer soils. The yellow head is quite small, destitute of ray, and contains about fifty flowers.

9. *Composites*—with milky juices.

This group includes—

Dandelions and their allies, with no aerial leafy stem.

Nipplewort, an annual with an aerial leafy stem, not wind-sown.

Sow-thistles, already described.

Dandelions.—In pasture and waste ground. This group of perennial composites is distinguished by the following characters, readily observed on a common dandelion: 1, fleshy tap-root; 2, root-stock forming a crown to the tap-root; 3, rosette of leaves spread on the ground; 4, *absence of leafy aerial stem*, therefore underlings; 5, yellow flower-head; 6, milky juice.

The seed-apparatus is the part sown: it is always provided with a crown of hairs, and scattered by the wind.

The following are distinguished:—

Flower-bearing stalk, unbranched.	*a.* Common dandelion, bald-skinned.
	b. Rough hawkbit, hairy-skinned.
Flower-bearing stalk, branched.	*c.* Autumnal hawkbit, with no chaff between the flower.
	d. Long-rooted cat's-ear, with chaff between the flower.

a. Common Dandelion (*Leontodon taraxacum*).—Everywhere. This tap-rooted perennial is reproduced by a characteristic seed-apparatus, which playful people use in order to ascertain the time of day. The peculiar feature is the stalk attached to the apex of the seed-box, so as to expose the crown of hair most completely to wind action. No plant is more perfectly adapted for wind-sowing: perfect adaptation explains the universal distribution of this weed. The diuretic property of dandelion is well known.

b. Rough Hawkbit (*Leontodon hispidus*).—In pastures. The skin of this weed is rough, with many hairs, not bald like dandelion; as in dandelion, the yellow flower-head terminates a simple stalk.

c. Autumnal Hawkbit (*Leontodon autumnalis*).—In pastures. This is a bald-skinned perennial, flowering in autumn. The flower-bearing stalk is not simple (as in dandelion and rough hawkbit), but branched, and accordingly bears several heads of flowers.

d. Long-rooted Cat's-ear (*Hypochœris radicata*).—In pasture. This weed has also the flower-bearing stalk branched, and is often confounded with autumnal hawkbit. When the flowers are pulled out of the head chaffy scales are found among them; there is no chaff among the flowers of hawkbit. The crown of the seed-box, too, distinguishes from autumnal hawkbit: as in dandelion, so here, a stalk lifts up the crown of hairs, and the wind has freer play, hence the frequency of cat's-ear.

e. Nipplewort (*Lapsana communis*).—In fields and on waste ground. This is a very common erect annual weed, marked by—1, small pale-yellow heads; 2, milky juice; 3, seed-box without crown of hair. The absence of the hair-crown absolutely distinguishes nipplewort from all other milky-juiced weeds. The seed-box is two or three lines long, somewhat egg-shaped but compressed, brownish-yellow, striated with twenty fine ribs—seen by a lens. There are no coarse ribs visible to the naked eye, as in ox-eye.

This seed-apparatus may occur as impurity in red and Alsike clovers, and in Italian ryegrass.

SECTION XIV.—TWINERS.

1. *Bindweeds*—on corn.

This group of weeds is distinguished by the twining habit of the stem. A stem is said to twine when it describes a spiral line round some support, such as a cereal straw. Twiners must not be confounded with leaf-climbers; in the former, the stem is the twining organ—in the latter, some part of the leaf is the climbing organ. Plants with twining habit of growth must, from their very nature, be denizens of rich soils: fibre is scant, and the plant is composed chiefly of living cells which make heavy demands upon soil. Two members of this group infest corn crops—

a. Small bindweed, with large and conspicuous flowers.

b. Black bindweed, with small inconspicuous flowers.

a. SMALL BINDWEED (*Convolvulus arvensis*).—The leaf-bearing stem describes a spiral line round a support, such as cereal straw. If extraneous support is not secured, the plant cannot attain erect position, and becomes prostrate. The weed is perennial, reproduced by seed, and propagated by the slender creeping root-stock running very deep into the ground, and accordingly very difficult to eradicate.

The bindweed is harvested with the cereal, but the mixed seeds are easily separated. Bindweed seeds are poisonous, and however cheap, ought not to be used for feeding purposes, and ought not to be incorporated in feeding-cakes.

The aerial twining stem seldom exceeds 2 feet in length. The leaf-blades are large, stalked, and arrow-shaped; the white flowers, tinged with pink, are very large and conspicuous, about 1 inch in diameter, and placed singly or few together in the axils of the leaves. The seed-apparatus is composed of a seed-box and four seeds. When ripe the seed-box opens by two valves to scatter and sow the seeds. The seed is very dark-coloured, 2 lines long, 1¼ line broad, narrowed at basal end, and triangular in section from mutual pressure when enclosed in the seed-box. The seed-skin is rough with projections: the food for the embryo is sparse, with no starch: the cotyledons of the embryo are characteristically folded. This bindweed accordingly adopts that common plan for securing rapid germination and a strong seedling—it makes the seed and embryo very large.

AGRICULTURAL PECULIARITIES.—This perennial and stubborn weed is often one of the most destructive that occurs in our corn crops. It is an attractive plant, and in moderate quantity may be comparatively harmless, but when it prevails to any

great degree in corn-fields it does much damage. Its twining stems wind themselves round the straw of the cereals and pull them down, when they ripen only with difficulty if at all, and yield a much diminished produce. It sometimes occurs in such abundance in parts of fields that on every stem of corn there may be seen a twisting bindweed. Even if the ripening of the corn be not altogether prevented by its presence, it renders harvesting more difficult, as the crop, if it contain much of it, cannot be removed from the fields and put into stacks till the weed is dried. Fortunately its injurious influence ceases at this point, as its seed can be readily separated from the cereal grain.

This weed propagates itself by means of its creeping root-stock, and also by its seed. There are no means of preventing the ripening of its seed among the corn, but its return to the soil can be avoided by the use of perfectly clean corn-seed. Its seeds are poisonous, and must not be fed to stock. Where their presence in manure is suspected or probable, it should be subjected to a prolonged and thorough fermentation before it is put on the land, in order that the seeds may be perfectly destroyed. The weakening of its root-stocks is to some extent naturally effected in pasture as they are choked out by the grasses, and the cultivation commonly given to root-crops destroys many of them. Mere ordinary ploughing, either in winter or spring, when the land is wet, rather tends to increase than to reduce it; but the proper exposure of the root-stocks to the sun, by fallowing in the dry summer, is an effective means of extirpation.

The cutting of its shoots as opportunity occurs also weakens, and may ultimately kill the root-stocks; on all convenient occasions they should be forked out and removed.

b. Black Bindweed or Climbing Buckwheat (*Polygonum Convolvulus*). — In corn on heavy land. This is an annual twiner, reproduced by the seed-apparatus, and destitute of organs for vegetative propagation. The seed-apparatus is here the part sown, and not the seed, as is the case with small bindweed. The part sown is composed of a seed-box, triangular in section, and a single seed, with mealy contents like buckwheat. The seed-box is usually invested by the persistent floral leaves. A true seed with such an investment is simply an impossibility: anything with an investment of leaves called by the name "seed," is misnamed. Stem and leaf are very similar to those of small bindweed. At the junction of leaf-stalk with stem, however, a characteristic outgrowth appears, forming a short tube round the stem—the *ochrea*, as it is technically called (see Docks). The flowers are greenish, and very small—not large and gaudy—arranged in loose clusters in the axils of the leaves:

the business of the plant is to make as much flower and seed as possible. The name *black* refers to absence of gaudy flowers. The triangular seed-box is black, not glossy, 2 lines long and 1¼ line broad. Under a lens the surface appears finely striated with minute points.

Large leaf-surface and nature of seed-apparatus fit black bindweed for heavy land.

2. *Parasitic Twiners*—on clover.

Any plant which obtains its whole food-supply from a living host is a complete parasite. Ordinary green plants insert roots into soil and absorb not food but food-making materials therefrom; parasites, on the other hand, insert roots into a host, and extract from it ready-made food. Absence of green colour and of green leaf are, accordingly, characteristic features of a completely parasitic mode of life. The typical example here considered is *clover-dodder.*

CLOVER-DODDER (*Cuscuta trifolii*).—A parasite on red clover. Dodder does not thrive in Scotland, because the climate is too cold. The opinion of farmers regarding it is well expressed by some of its common names: *scald-weed, hell-weed, strangle-weed, devil's guts,* and so forth. The name *dodder* refers to the dottering way in which the plant rambles among and over the clover plants. It is a representative of the twining type, using the plant infested not only as a support like respectable twiners, but as a host to be preyed upon: from the host and from the host only all the food required for dodder growth is obtained. A plant feeding and preying upon a host is a parasite, and the character of the weed is expressed by the two words *parasitic twiner.* This mode of life is necessarily associated with certain peculiarities of organisation, such as absence of green leaves, absence of terrestrial roots, presence of roots inserted into host for extracting nutriment (suckers), and so forth.

Dodder is an annual reproduced by seed—seed which retains its vitality, although buried in the ground for four or five years. However, this buried seed has not to be reckoned with in Britain, because dodder can scarcely ripen in our climate. If an outbreak occurs, in all probability the seed sown out contained dodder as an impurity. The seed germinates with the clover, and the parasite usually attacks the seedling clover at a very early period when the two cotyledons are alone developed. As the host grows the parasite grows with it, slinging round and round and inserting suckers into the young and tender parts as they develop. All connection of the parasite with the ground is lost soon after seizure of the prey.

Clover attacked by the parasite shows that most characteristic symptom of plant-illness—change of the green colouring matter; the affected spots of the field betray themselves by yellow appearances resulting from this change.

Since dodder contains acrid and purgative poison, the attacked clover must not be used for feeding purposes, but burnt or otherwise destroyed.

The stem is leafless, elongated, thread-like, and yellowish, resembling the gut of a fiddle-string, with numerous long branches which catch new hosts by their groping and dottering movements. The flowers are in compact lateral clusters, sessile and whitish, each about 1 line in diameter. The seed-apparatus is composed of the seed-box and four seeds. The box opens transversely for seed scattering and sowing.

Dodder-seed is slightly smaller than that of white clover, about $\frac{3}{8}$ of a line in diameter, brown, almost globular, but somewhat angular from mutual pressure in the seed-box. The surface is not glossy like clover-seed, and under a lens it appears minutely granular. The embryo is yellow, wound round the clear central food-mixture, and has no cotyledons—a very characteristic feature.

Dodder occurs as impurity in the small-seeded Continental clovers, and in Timothy sieved off from clover.

Seed of parasitic plants, in general, must be small and very abundant; few, indeed, of the many seeds produced are capable of reaching a suitable habitat and host.

SECTION XV.—LEAF-CLIMBERS—in corn.

Leaf-climbers which injure corn crops are, as a rule, leguminous plants, marked by the shape of the flower and the legume form of seed-apparatus. The climbing organ is some part of the leaf—usually the apex. A leaf-part used for climbing becomes an elongated thread describing a spiral line round the crop plant which serves as support.

Hairy vetch may be taken as a typical example.

Hairy Vetch or *Common Tare* (*Vicia hirsuta*)—in corn.

This is a weak plant, deficient in skeleton, incapable of maintaining erect position without extraneous support. The leaf-apex is modified to suit this want, and converted into a branched thread-like organ, capable of describing a spiral line round a cereal straw, for instance: the name *fetterweed* draws attention to this peculiarity. This feature is also referred to in the common name *tine-tare*, the tare which *tines* or encloses and

imprisons other plants. This weed accordingly represents the climbing type, and the climbing organ is the leaf-tendril.

Being an annual, reproduction is accomplished by seed. The seed requires much water for germination, can lie in the ground for many years without loss of vitality, and can pass without injury through the alimentary canal of an animal—hence its presence in dung. This tare is harvested with the cereal, and the tare-seed is mixed with the cereal grains.

The leaf is composed of 6 to 10 pairs of leaflets, arranged along a midrib which ends in a branched tendril. The leaflets are strap-shaped, less than $\frac{1}{5}$ of an inch in length, with a notch and a prong at the apex. The flowers are small and insignificant, pale-blue, in axillary clusters of two or three, placed at the end of a long stalk. The seed-apparatus is a hairy legume about half an inch long, containing two seeds only. The seed is globular, somewhat compressed, about $1\frac{1}{2}$ line in diameter. The skin is smooth and black. The scar is long and linear, occupying one-third of the whole circumference of the seed.

Agricultural Peculiarities.—This leguminous weed occurs in greatest abundance in wet summers, when it sometimes does great injury to cereal crops. It twines its tendrils round the corn plants, and may grow in such profusion as to entirely choke the crop. It is difficult to eradicate, as its seeds retain their vitality for a long time, and come up in rainy seasons. The weed forms a nutritious addition to fodder, but its seeds may pass uninjured through the alimentary canal of animals, and be conveyed in the manure back to the fields. Corn containing its seeds, or indeed the seeds of any weeds, should always be crushed before being given to stock, to ensure their digestion and destruction. If this be not done the manure produced should be subjected to a thorough and prolonged process of rotting.

When the seeds have been conveyed to the land, the only method of dealing with the weed is to drill-sow the corn and to repeatedly horse-hoe it.

Section XVI.—Hook-Climbers—in corn.

These, like twiners and leaf-climbers, are deficient in skeleton, and require extraneous support in order to gain access to light and air. Hair outgrowths of the skin take the form of hooks, and by hooking on to neighbouring plants light and air are secured. A typical hook-climber is exemplified by cleavers.

Cleavers (*Galium aparine*)—on corn and waste land.

This is an annual weed, destitute of perpetuating apparatus. The leaves are arranged in whorls round the stem—a very

characteristic feature. The flowers are small and white, clustered in the angles between leaf and stem. Each flower produces a seed-box, covered, like the rest of the plant, with hooks. When ripe the seed-box splits into two pieces, each enclosing a seed. The part sown is this seed imprisoned in its box; distribution is due to animal agency—the seed-apparatus simply hooks on to a passing animal.

Cleavers is sometimes called *goose-grass,* from a belief that goslings feed on it. The name goose-grass is applied also to *Bromus mollis.* Many names indicate the catching character of the weed: *catch-weed, grip-grass, clithe, cliders,* &c.

SECTION XVII.—YELLOW RATTLE (*Rhinanthus crista-galli*) —in hay.

This is an erect and bald-skinned annual. The stem is rounded, and the leaves in pairs. The flowers are yellow, as indicated by the name, two-lipped, without stalk, and placed in the axils of the leaves. As is the rule among annuals, flower formation commences early, continues through summer, and may even extend into autumn. Each flower produces a single seed-box, which opens at maturity in order to allow the numerous seeds to escape. When the plant is shaken the seeds within the seed-box make a rustling noise, hence the name *rattle.* Some seed has been already matured when the hay is ready for cutting. Wind is the chief agent used by this weed for seed-scattering: seed flatness and lightness, together with expansion of seed-skin into a broad membraneous wing, are here the special adaptations for wind action.

The behaviour of some of the fibre-roots is interesting and peculiar; they enter into the roots of grass plants in their neighbourhood, and appear to obtain some ready-made food in this way. Rattles are, accordingly, regarded as *partial parasites.*

On poor wet land, among poor grass and hay, yellow rattle is often quite abundant: it marks poverty both of land and of produce.

AGRICULTURAL PECULIARITIES.—This small annual weed occurs very abundantly in poor and damp meadows in most parts of Britain, and multiplies to such a degree as to diminish to a material extent the produce of grasses, and to injure the quality of the hay. Both in the green and dry condition it is an unpalatable weed, and is disliked by cattle. Some of its seeds always ripen and fall on the ground before the time of hay-cutting, so that its continuance in a regularly mown meadow in which it has become fairly established is ensured. Grazing

with sheep in the late spring for some years will reduce it, and if the grazing be continued during a whole season it will be pretty well extirpated.

In some experiments, conducted in 1893 by the Glasgow Technical College, on the manuring of meadows, it was found to be completely destroyed by top-dressings of salt. The salt was applied in dry sunny weather in the end of April, at the rate of about 6 cwt. per acre. This dressing burned the surface of the pastures very badly, but the grasses recovered when rain came, and gave an increased produce. The yellow rattle, however, was completely exterminated.

Section XVIII.—Self-Heal (*Prunella vulgaris*)—in poor pasture.

This is a perennial of low stature, reproduced by the seed-apparatus, and perpetuated by the shortly creeping root-stock. It occurs in pastures and marks sterility, as indicated by one of its common and very pathetic names, *blaw-weary*.

As in all members of the self-heal family, the stem is square and the leaves opposite; the skin is thinly clothed with hair. The two-lipped blue flowers arranged in a terminal spike are characteristic; equally so is the two-lipped dark-purplish calyx closed over the seed-apparatus. Four seed-apparatuses are formed by each flower; these are arranged on transverse section, like quadrants of a circle, and shaped accordingly with two inner flat surfaces and an outer convex. The seed-box is broad and rounded at the upper end, tapered to the base, smooth, glossy, and yellowish brown, $\frac{3}{4}$ to 1 line in length, and $\frac{1}{2}$ line thick. When softened in water four mucilaginous lines may readily be noticed.

This seed-apparatus occurs as impurity in red clover and Timothy.

Section XIX.—The Dock Family.

The family is easily recognised by the presence of a peculiar leaf outgrowth which takes the form of a tubular sheath surrounding the stem. This tube, from its resemblance to the leg of a top-boot, is called *ochrea*. The part sown is always a seed-apparatus of triangular outline except in redshank. The groups of this family dealt with here are—

1. Docks, with large leaves.
2. Sorrels, with acid leaves.
3. Knot-grass, with leaves narrow, like those of a grass.

4. Redshank, with flowers clustered at the end of a red stalk or "shank."
   Black bindweed, already considered, distinguished by twining habit.

1. *Docks* or *Dockens*—in grass.

These tall broad-leaved perennial weeds of grass and waste land are reproduced by the seed-apparatus, and perpetuated by the underground parts. The organs for perpetuation descend vertically to a considerable depth — there is no horizontal "creep" about the docks.

Thickness and fleshiness characterise the underground parts, for these weeds habitually store away a considerable amount of root, stem, and leaf-making materials in proper place—namely, in the persistent organs underground. When carefully examined, this fleshy structure is found to be composed of a tap-root crowned by the root-stock. The root-stock is a mere neck placed at the apical end of the root—the "crown of the root," as the saying is. Filamentous remnants of leaves produced during previous leaves mark off the root-stock from the root proper. Under normal conditions, the air-parts of docks are developed exclusively from the root-stock, and one might suppose that crown removal would destroy the weed. This is not so, however; any fleshy part left in the ground renews the dock.

Dock-leaves are characterised not only by great length and breadth, but by a peculiar outgrowth at junction of leaf and stem. This outgrowth is a long tube, like the leg of a top-boot, sheathing the stem, and called *ochrea.*

Several kinds of dock occur, but the broad-leaved form is alone considered here.

BROAD-LEAVED OR BLUNT-LEAVED DOCK (*Rumex obtusifolius*).—In grass and waste ground. The lower leaves are very large, 6 inches to 1 foot long, one-half or one-third as broad. The base of the blade is notched like a heart, not tapered into the stalk, and the apex is blunt. The name *butter-dock* refers to the use of these leaves for wrapping butter. The seed-apparatus—the part sown for reproduction—is composed of a seed contained in a triangular box. The seed-box is 1½ line long, about half as broad, glossy, and yellowish-brown.

As a seed impurity dock is much less common than sorrel: it occurs in clovers—red, Alsike, and white—also in Timothy and Italian ryegrass.

In hay this species of dock may be distinguished by the envelope of the seed-apparatus formed by enlargement of the three

inner leaves of the floral envelope. These leaves are triangular in outline, toothed along the lower part of the margin, and one of the three has a tubercular swelling.

AGRICULTURAL PECULIARITIES.—The dock is one of the most difficult weeds to eradicate, and it is fortunate therefore that it does not extend itself over cultivated land so readily as many others, as it is furnished neither with winged seed-vessels nor creeping root-stock. It is to be found chiefly on spots of good soil, along roadsides and fences, or on neglected heaps in the corners of fields. Its tap-roots strike deep into the soil, and fasten themselves so firmly that they can hardly be pulled out completely by hand. Even when the ground has been well softened by rain the roots usually break in pulling, and the fragments left behind will produce plants. Nothing short of deep digging will eradicate them at once from pastures, though early and continued cutting of the stems will gradually weaken and reduce them. They can be effectively cleared from the land during root-cultivation and in bare fallowing, provided that ploughing be deep, and that care be taken to gather up every broken part of the root. Mere exposure on the surface during the summer fallow may wither them up, but they will soon recover again when rain falls, and will send up shoots with undiminished vitality. Every root must be gathered and removed, or the fallowing will prove ineffective for their destruction.

2. *Sorrels*—in grass.

The sorrels are perennial weeds, easily recognised by the acid taste of the leaves, due to the presence of acid oxalates.

Two sorrels occur as weeds: 1, common sorrel or sourock; 2, sheep's sorrel. The latter is alone considered here.

SHEEP'S SORREL (*Rumex acetosella*).—Marks sour land. This is a perennial weed of low stature, reproduced by the seed-apparatus, and propagated by the shortly creeping root-stock. Like its ally the "sourock," it is easily recognised by the acid taste, due to acid oxalates. Abundance in a pasture is a bad sign, marking sour land in want of lime. The herbage is often regarded as good for sheep, hence the common name; but agriculturists are not unanimous on this point, many regarding it as injurious, especially at the seeding stage.

The characteristic feature of the lower leaf-blades is the pair of long-pointed ears spreading at right angles to the blade. Two kinds of flowers are produced—the pollen-makers on one plant, the seed-makers on another. The flowers are small, and grouped in slender terminal panicles which turn red. The seed-apparatus is composed of a seed imprisoned in a triangular box. The seed-box is small, broadest near the base, approxi-

mately equal in length and breadth (about ¾ of a line), glossy, and reddish-brown.

This is one of the most frequent impurities in clover-seed —in red, in Alsike, and in white; it is also found in Timothy, perennial ryegrass, and hard fescue.

AGRICULTURAL PECULIARITIES.—This is a perennial plant in light soils of an inferior character. It is not in itself a very troublesome weed, but its presence indicates a sour or unwholesome character of the land. Any treatment that improves the condition of the soil is beneficial, such as liberal manuring and good cultivation. The application of lime forms the best specific against it; and any other manures that contain a percentage of lime are suitable for soils on which sorrel abounds.

3. *Knot-grass* (*Polygonum aviculare*)—in fields and on waste ground.

This is a very much branched annual, reproduced by the seed-apparatus, and destitute of perpetuating organs. Knots, for propagation, such as mark knot oat-grass, have no existence here.

The stem is wiry, with abundant skeleton, and stands erect when erectness is an advantage amongst corn or grass. When the land is bare and competition absent, the spread-out *prostrate* habit is assumed. The stem has many joints, often swollen, and bears small narrow leaves like those of a grass, rarely reaching an inch in length. The name *knot-grass* refers to these features of stem and leaf. The flowers are small, and arranged in clusters seated in the axils of the leaves—not at the end of a stalk or "shank." Each flower produces a single triangular seed-box containing a seed. This whole seed-apparatus is the part sown, and the part eagerly sought by birds, hence the specific name *Aviculare*. The seed-box is 1½ line long, ¾ line broad, not shining, dark-brown, and under a lens shows fine ribs or dots.

4. *Redshank* or *Spotted Persicaria* (*Polygonum persicaria*)—among dunged crops.

This annual weed usually grows erect. The small green- or rose-coloured flowers are arranged in cylindrical clusters at the end of a shank or stalk whose skin is red, hence the name *redshank:* the presence of the "shank" readily distinguishes from knot-grass. The leaves taper to apex and base; the larger are 3 to 5 inches long and about an inch broad, often marked in the centre with *a dark blotch.* The seed-apparatus is the part from which the weed is reproduced: *flatness,* dark-

ness, and gloss are its characteristic features. It constitutes a frequent impurity of dung, of grass and clover seed. The seed-box is 1¼ line in diameter, glossy black, orbicular in outline, flat on one face and convex on the other; the style persists as a projecting point at the apex of the seed-box. Very little water is required for germination—a peculiarity connected with prevalence and distribution of the weed.

A perennial species of redshank (*Polygonum amphibium terrestris*), with an extensively creeping root-stock and rough narrow leaves, is sometimes a troublesome weed.

AGRICULTURAL PECULIARITIES.—This annual weed prevails most extensively on low-lying lands, but does not, as a rule, affect the crops to a markedly injurious degree, except in the case of the sown-out corn after roots. Should the sown-out corn come up slowly owing to the continuance of a dry spring, the redshank may attain to such dimensions as to choke and smother the young corn plants. Its seed is capable of germinating with little moisture, and hence, in such circumstances, it readily overtops the corn.

It is in itself a nutritious plant, and may be given as fodder either to horses or cattle. If it occur merely as a mixture in grass or corn-straw, or any leguminous fodder, they will eat it freely. Its seeds form a common impurity in grass and clover. ✓The ordinary cleaning operations followed in growing root crops tend to reduce it, and a few years' successive root-cropping will kill it out.

SECTION XX.—MEALED-WEEDS OR MELD-WEEDS—on dunged land.

The name refers to the characteristic mealy skin possessed by these weeds. The skin is in reality hairy; at the end of each hair is a large cell, readily rubbed off, and resembling a grain of meal. These hairs are so numerous that the plant appears as if dusted with meal. The members of the group considered here are—

1. White meld-weed, with rhombic leaf, and of erect habit.
2. Spreading orache, with triangular leaf (especially the lowest), and of prostrate habit on bare land.

1. *White Meld-weed* or *White Goosefoot* (*Chenopodium album*)—in root crops.

The plant is an erect very mealy annual, 2 feet or more in height. The leaf-blade is shaped like a goose-foot; the base is wedge-shaped, without teeth or toe, and runs into the petiole;

the apex is egg-shaped, with blunt marginal teeth or toes. The flowers are very small, green, and inconspicuous, clustered in sessile spikes. Each and every flower is capable of producing a seed-apparatus containing a single seed. The seed, which readily escapes from the seed-box, is a flat round disc, about half a line in diameter, with upper and lower surfaces, quite black and glossy.

Agricultural Peculiarities.—This coarse and rank annual weed has a wide distribution, but is found especially on naturally good land or land highly manured and in rich condition. Hence it may be commonly seen on heaps of waste material, on roadsides or fields, enriched by decaying organic matter. In arable cultivation it is to be seen almost exclusively on root crops, and especially on the potato crop; and when crops of early potatoes are left undug in the fields for any time after they have attained to maturity, they are sometimes badly overrun with this weed, and so deeply and firmly does it root itself in the ground that it can only be pulled up by the exertion of some force, and forms a serious obstruction to the hand-digging of the potatoes.

The seed is very abundant, and retains its vitality in the ground for many years. The first step to the destruction of the weed, therefore, is to prevent its seeding, and this may be effectively done by hand-pulling all the weeds before they flower. As they are only found in root crops, this can be effectively accomplished; but it is essential that when pulled the stems should be removed from the field if they have flowered, or they will succeed in ripening their seeds and shedding them on the ground. Putting the plants in an ordinary manure-heap may not suffice to destroy the seeds, and the plants should either be burnt or mixed with quicklime. In order to their successful germination the seeds require a high temperature, hence when the germination occurs in cereal crops or on pastures the young plants are crushed out by these earlier growing crops.

In the drilled root crops, however, there is room enough for them to grow up even when the other plants have got ahead of them, and as they grow on the top of the potato-drills the ordinary tillage between the rows does not affect them. Neither does the earthing-up of the potatoes check them; for when once germinated their strong shoots are capable of forcing themselves through the coating of earth above.

✓ Though these weeds have a distasteful appearance and an unpleasant smell, they are eaten by both sheep and cattle, and are especially liked by swine; and if pulled up at flowering-time they form a nutritious fodder.

The cutting of the stems to prevent seeding is frequently

resorted to instead of pulling, but it is, unfortunately, too often rendered ineffective by being done so late in the season that the stems, even when deprived of their supplies from the roots, are still able to ripen a large number of their seeds. The cutting must either be done early in the season, or the stems must be collected and removed from the fields. In dealing with this, attention to the plants growing by the sides of fences and roads is essential; and as the seeds are not very readily conveyed from one farm to another, it is possible by care and assiduity to secure the entire extirpation of this weed.

2. *Spreading Orache* (*Atriplex patula*)—in fields and on waste land.

The orache is an annual reproduced by the seed-apparatus, and destitute of perpetuating organs. The temperature required for seed germination is comparatively high, and accordingly the vegetative processes commence relatively late—an important point in connection with prevalence and habitat of a weed. Orache and all its allies—such as goosefoot and mangel—love salt, warmth, and well-manured land.

The stem produces many long branches, well spread out along the surface of open ground, but in shade "drawn up" and more erect. The name *spreading* refers to this stem peculiarity, and *orache* to the use of the plant for curing aches—golden aches, yellow aches, jaundice, in fact. The leaf is composed of a leaf-stalk, and a broad triangular blade toothed along the margin. The triangular shape of blade distinguishes orache from goosefoot. The flowers—small, green, and inconspicuous because petals are absent—are disposed in spike-like clusters. The plant behaves like many annuals, commences to form flowers at an early period of life, and continues to do so till the end of the season—hence the distribution of the flower-spikes over the plant. Two kinds of flowers occur mixed together on one and the same plant: 1, pollen-makers; 2, seed-makers. The seed-making flower is enveloped by a pair of leaves—like an oat-flower enclosed by the husk or chaff—and as maturation goes on these enveloping leaves enlarge, elongate, and become exceedingly conspicuous. At this stage confusion between orache and goosefoot is impossible; the two valve-like green leaves enclosing the seed-apparatus distinctly mark the orache.

The seed-apparatus contains a single seed, easily removed from the seed-box. This seed is black, very flat, of circular outline, $\frac{3}{4}$ of a line in diameter, and finely wrinkled when examined by a lens.

SECTION XXI.—RIB-GRASSES—in clover and grass.

Agriculturists apply the term grass to all narrow-leaved plants, whether true grasses or not. Knot-grass is not a true grass, neither is rib-grass. The ribbing of the leaf is the most characteristic feature of this group. The ribs are very prominent on the lower surface, run along the length of the blade, and follow the curvature of the leaf-margin. Rib-grasses, like dandelions and daisies, never produce an aerial leaf-bearing stem; from beginning to end they are *underlings*. All the leaves spring from the root-stock—apparently from the ground —and are arranged in the form of a rosette spread on the ground. A naked simple stalk, with a spike of flowers at its apex, is all that rises into the air. The perpetuating apparatus is underground, and composed of a fleshy tap-root, crowned by the root-stock.

Rib-grasses are not always considered weeds: they are often purchased and sown in clover and grass mixtures. From their habit of growth, it is plain that other plants, occupying less area of the land, would give larger yield—and if so, why grow rib-grass?

Wide distribution is secured in peculiar fashion. Birds are very fond of the seed, and when they alight to seek it, the mucilaginous skin of any seed on the ground becomes attached to the feet. When the bird again alights the seed may detach from its foot, and in this way wide distribution is secured. Two species are here dealt with:—

a. Common rib-grass, with narrow leaf.
b. Greater rib-grass, with broad leaf, usually called plantain.

1. *Common Rib-grass* (*Plantago lanceolata*)—in clover and grass.

The root-stock is not at all creeping, but merely a short necklike prolongation of the fleshy tap-root. The leaves at once distinguish the plant. They are arranged in rosette-form at the ground, are narrow in the centre, and still narrower both at apex and base, thus assuming the lance shape; the riblike veins are parallel, and, following the outline of the leaf, converge to apex and base. Narrowness of leaf and parallel ribbing have caused confusion with grass; presence of the tap-root, however, at once dispels this delusion. The flowers form a short spike placed at the end of a long *furrowed* stalk, which escapes from the leaves. This stalk, and the spike of flowers at its end, is the part used for the game of "sodgers" and "cocks." The seed-box is dry and papery, partitioned into

two chambers, and contains two flat seeds, one per chamber. The seeds escape when the upper half, or rather two-thirds, of the seed-box falls off—a very characteristic mode of opening. The seed is $1\frac{1}{2}$ line long and $\frac{5}{8}$ line broad, shaped like an elliptical shield, convex on one surface and concave on the other, of dark-brown or yellowish-brown colour. The seed-skin, when moistened, becomes mucilaginous, like the skin of linseed.

Rib-grass seeds occur very frequently as impurity in clovers, and in grass-seeds—perennial ryegrass, Italian ryegrass, and Timothy. Sometimes the unopened seed-apparatus constitutes the impurity.

When rib-grass seeds are "sulphured," they become bleached and whitened. It is, accordingly, easy to detect clover-seed doctored by "sulphuring"—any dark-coloured impurity is bleached. Oiled seed may also be detected by observing that impurities naturally dull have become glossy.

2. *Greater Rib-grass* or *Plantain* (*Plantago major*)—in grass and on roadsides.

This species differs from common rib-grass in the following respects:—

1. The leaves are broad, not lance-shaped but egg-shaped.
2. The stalk of the spike is cylindrical, not furrowed.
3. The spike of flowers is elongated.
4. The seed is flat, not concave, on the inner surface.

The seeds of greater rib-grass occur as impurity in Timothy, &c.

SECTION XXII.—WEED-OATS.

Two species of weed-oat occur in corn—

1. Black oat or bristle-pointed oat (*Avena strigosa*).
2. Wild oat or haver (*Avena fatua*).

Both are annuals reproduced by a seed-apparatus like that of cultivated oat. Many farmers consider that crop oats degenerate into the weed forms. However, if the seed which produces the crop is true and genuine, and if no seed of weed-oats is lying in the land, the crop must also be true—at least approximately so.

1. *Bristle-pointed Oat* (*Avena strigosa*).

The seed-apparatus—the part sown—is composed of the grain enclosed in a husk of two pales, the lower and the upper with the stalk. The lower pale has a long dark awn springing from

the middle of its back, and two shorter awns, like bristles, from its apex. These apical awns do not occur in crop oats.

2. *Wild Oat* (*Avena fatua*).

The seed-apparatus—the part sown—is composed of the grain, the lower and upper pales, and the stalk. The lower pale is dark coloured, and has always a long awn. Its basal half is clothed with bristly hairs. The stalk is also hairy.

Wild oat is distinguished from bristle-pointed oat by the following characters:—

1. The ear is very lax, and ultimately its branches spread in all directions.
2. The lower pale is darker in colour, its basal half clothed with bristly hairs, and its apex provided with two very short bristle-like awns.

AGRICULTURAL PECULIARITIES.—The wild oat is a common annual weed that occurs both in oat and barley fields, but is most noticeable in the latter. It is of most frequent occurrence in corn after roots; and as its grains can be carried about by the wind, it readily spreads over the country, and is not easily extirpated. In order to get rid of it the first essential is to sow seed that is quite free of it; and no seed-corn should be used from a field on which this weed has been seen, as it is practically impossible to separate it entirely from the corn.

Thorough cleaning of the root crop is an effective remedy against it, as its young plants are destroyed before they develop seed; and if this be constantly observed, and only pure oat and barley seed be sown, the weed may be exterminated.

SECTION XXIII.—ANNUAL BROME OR GOOSE GRASSES—in corn, &c.

Heavy ear composed of large spikelets, the notch in the apex of the lower pale, and the unsplit sheath, characterise the group. Two species are common:—

1. Rye brome, not hairy.
2. Soft brome, very hairy.

1. *Rye Brome-grass* (*Bromus secalinus*)—in corn and hay.

This is an annual or biennial weed, reproduced by the seed-apparatus. The seed-apparatus—the part sown—is composed of a grain enclosed in a husk of lower and upper pales, and a stalk. Germination is favoured by wet seasons, and may occur in early spring or in autumn. In the former case the brome is

annual, in the latter biennial. Though in the ground, the seed-apparatus may lie dormant for three years or longer. A wet season, however, starts it into active life.

This grass occurs as impurity in cereal-seed, grass-seed, and dung. Taking all these circumstances into account, it is easy to understand how some farmers are of opinion that cereals degenerate into bromes in wet seasons, or, if superstitious, how they fancy that an evil spirit has come by night and sown brome among the corn.

The skin of brome-grasses is usually hairy—this species, however, least of all, hence the epithet *smooth* often applied to rye brome. The sheath of the leaf is entire, not split, except at the apex. Flowering takes place in June, ripening in July. When ripe the lower pales curl strongly inwards; compact appearance of the spikelet is thus lost, and the very characteristic spreading spikelet is the result. The fruit (seed-apparatus) is without the awn, 3½ lines long, greenish-yellow, and firm. The lower pale has a short, sometimes no awn, is rolled inwards, and curved, not angular, on the margin. The upper pale is of equal length with the lower, not shorter, as in soft brome-grass. The stalk is characteristic, marked by the swelling beneath the apex. This feature is common to brome-grasses.

Agricultural Peculiarities.—This biennial grass appears frequently in wet seasons in great quantity in lea corn; and in parts of Wales, where it is of common occurrence, it is thought by many that the other cereals have changed into it. In dry years it is comparatively unnoticed, as its seeds require abundant moisture in order to germination; but they retain their vitality for a long time, and in wet years the plant springs up most unexpectedly in great abundance. Its seeds, if fed to stock with the fodder or with other grains, pass unchanged through the animal, and may be conveyed back to the field in the manure. Where their presence is suspected the manure should be subjected to a thorough and prolonged fermentation.

Care should also be taken not to sow grain or grass-seeds containing the brome.

2. *Soft Brome* or *Goose Grass* (*Bromus mollis*).

Softness is due to the downy skin: the soft touch of the grass immediately distinguishes from rye brome. The seed-apparatus is easily recognised—the upper pale is *shorter* than the lower.

SECTION XXIV.—BULBOUS OAT-GRASS, KNOT OAT-GRASS or PEARL-GRASS (*Arrhenatherum avenaceum bulbosum*)—in fields and on roadsides.

This is a light-land grass with hairy skin. Its ear resembles that of oat-grass. The great peculiarity is this: the underground joints of the stems are considerably swollen, and have become store-houses of nutriment—the "bulbs" or "pearls." A single swollen joint suffices to produce a plant. The "bulbs" or "knots" are produced rapidly, and in large numbers; eradication is accordingly difficult.

AGRICULTURAL PECULIARITIES.—This strong and vigorous growing grass forms one of the most troublesome weeds of arable land and also of pasture, where, when once established in the land, it holds firm possession to the exclusion of better plants. It extends both by root and seed, and its seeds are produced freely and abundantly. In pasture-land the ripening of its seeds may be prevented by regular grazing, but attention must also be given to wayside heaps and corners, in which it may be frequently seen flourishing.

In cereal crops its stems shoot above the height of the corn, and produce their seeds in security and with great facility. The absolute prevention of its seeding, when the plant has once established itself on land where corn crops are grown, is impossible, and efforts for its extermination must be directed chiefly to the destruction of its bulbous roots. This may be most effectively accomplished by paring and burning the surface of the land. Where this method is not practised, the removal of the roots may be attempted by the system of cleaning the land in autumn that is more fully described in dealing with the treatment of *couch*.

A special difficulty attends the removal of the oat-grass, because the knots or bulbs of the roots are apt to break off from each other during the harrowing, and no implement is then able to collect them. Each knot left on the field is capable of producing a new plant, hence the ordinary processes of cleaning are too often found ineffective. The separate bulbs left on the surface of the field may, however, be killed by the alternate frost and thaw of a severe winter, but a very slight covering of earth suffices to keep them in safety. The parching exposure of a summer fallow will also kill some, but their entire removal from the field is to be recommended.

In the cultivation of green crops, the roots are not killed, but their extension is prevented. Should any remain on the field when the corn crop after roots is sown, there remains no thoroughly effective remedy except careful picking by hand, which should be done after the land has been harrowed.

SECTION XXV.—COUCH OR TWITCH GRASS (*Triticum repens*)—chiefly on light land.

This is a perennial grass, reproduced by seed-apparatus, and propagated by root-stock. The seed-apparatus—rarely matured among crop, but often in the hedges—is a grain enclosed in a husk, composed of the lower pale and the upper pale with the stalk. The root-stock creeps extensively and branches freely underground. When this root-stock is cut into pieces—by a plough, for example—the plant is not killed but multiplied, because each part of the stock stores away in its interior root- and shoot-making materials, drained from the green aerial leaves during the period of vegetation.

This weed, like all perennials, has a great advantage over annuals and newly-sown plants—it is largely independent of season, and works upon material formed and stored away during previous years. A plant to hold its own must be a rapid upward grower, such as a cereal—not one which tarries to establish itself in the ground, and is slow to commence upward growth. When overtopped and overshadowed by a cereal crop, the aerial stems of couch are "drawn up," and the root-stock is in somewhat exhausted condition. The rational time to take measures for eradication is when the plant is weakest, immediately after removal of the cereal crop. To dung the weed, and to give the land over to it till spring, is the height of folly. To take the root-stocks of couch to a dunghill, to carry them with the dung back to the field, to spread them broadcast, is not farming.

The skin of couch is hairy, a character most readily noticed when the surface of the blade is drawn along the tongue. There is never hair on bent-grass or white grass (*Agrostis*), which is often confounded with couch.

The base of the leaf-blade has two features which distinguish couch from every other grass:—

1. A pair of pointed ears.
2. The ligule or tongue is so short that it appears to be absent.

In *Agrostis* the ligule is a conspicuous white membrane.

The green leaf manufactures the food of couch, and if removed by depasturing for three years in succession, the weed dies out from sheer starvation.

AGRICULTURAL PECULIARITIES.—The couch is a further example to some already mentioned of a plant possessing valuable food properties in proper circumstances, that by its occurrence in crops where it is not desired has earned the character of one of our most pestiferous weeds. Both in its stems and root-stocks it is a nutritive plant, and it is often a useful grass on meadows.

But the difficulty of destroying it in other crops, and the extent to which it usurps the ground to the exclusion of better plants, cause it to be regarded generally as one of the most troublesome weeds with which the farmer has to contend.

It is especially dreaded on light soils, where its creeping root-stocks extend themselves with remarkable rapidity through the surface, sending up plants from every joint. On stiffer soils it is more manageable, as its root-stocks do not readily penetrate through tough or tenacious earth. On the heavier lands the weed is spread perhaps as much by its seed as by the root-stock, whereas on light soils its extension is chiefly due to the action of the latter.

Its development is greatly favoured by the growth of leguminous crops, or any crops that are slow of coming up in spring, as the couch is thus allowed a free field in which to establish itself before the cultivated crop enters into competition with it; and it benefits fully by the tillage and manuring that are intended for the advantage solely of the farm crop. The bean crop, therefore, suffers very badly from couch, and in a less measure the corn crops. Even if kept well under in the spring, the couch remains ready to take advantage of any failure of the summer crop to extend itself over the soil. A poor potato crop leaves room enough for it to develop between the drills; and the failure of a bean crop gives the couch an admirable opportunity to usurp entire possession of a field.

The practice of applying farmyard manure to the fields in autumn also favours it greatly, as the manure enables the root-stocks to develop themselves freely before the spring; and if a field be badly infested with couch, it may be desirable to defer the application of the farmyard manure till it can be thoroughly cleaned, or till immediately before the planting or sowing of the spring crops. The extermination of this weed on light and medium soils is a matter of the greatest difficulty, because the roots break readily, and each part or fragment left in the soil is capable of forming a new plant. On the heavier soils, if its absolute removal be not easily effected, it is by no means hard to keep it under, owing to the obstacles imposed by the soil to its extensive development. An ordinary surface-cleaning of the land, by grubbing, rolling, harrowing, and gathering up the roots, will suffice to keep this weed well down; and in summer fallowing the mere exposure of the root-stocks on the surface after they have been torn out may suffice to kill them, though, except in a very dry and hot climate, their destruction will be better ensured by their entire removal.

If after the land has been thoroughly cleaned in this fashion any broken fragments of roots remaining are buried by a deep ploughing, they will be so much weakened and starved by the

exclusion of air and light that they will do little damage to the crop, and many of them will never be strong enough to penetrate through the stiff clay above them to the surface. On lighter soils the destruction of the couch is rendered more difficult by the stronger development of its root-stocks, and by the ease with which they extend themselves through the surface. As no summer fallowing is practised on these soils, their complete removal from the field has to be accomplished during the brief period allowed for autumn or spring cleaning prior to the growth of a root-crop. If the weather be dry, the cleaning ought to be done on the stubbles immediately after the corn has been removed in harvest, as the root-stocks have at this time been weakened by the overshadowing of the corn.

If the cleaning be deferred till spring, the root-stocks may have become greatly developed during the winter if the season has been mild, and they then possess greater vitality and are more ready to shoot out new plants from every fragment. The cleaning operation should be begun by completely scarifying the surface of the stubble to a depth of 3 inches or so by means of a scarifying-plough, or by the use of broad-tined grubbers. Rolling and harrowing should then be done as often as is required to break down lumps and to shake the couch free from the earth. Sufficient time should, if possible, be allowed between each operation to allow the surface to become quite dry, as otherwise the root-stocks cannot be so easily separated from the soil. Finally, the root-stocks, having been completely loosened out, should be collected by the chain-harrow and by hand-gathering, and should be burnt on the field, or removed and mixed with quicklime to form a compost. Putting them in heaps of farmyard manure will not destroy them, unless the heap be made to undergo a very complete and thorough fermentation. Afterwards the land may be deeply ploughed to bury any remaining fragments of the root-stocks, of which, owing to their brittle nature, only too many will have been broken off by the grubber and harrows; and a heavy rolling to consolidate the land will assist in preventing their renewed growth.

If after this a strong crop of rape can be grown, or thick and heavy crops of corn, the remaining weeds will be still further reduced. Laying the land down to pasture is an absolute cure. In two years the couch will have greatly diminished, and in three it will have totally disappeared.

Section XXVI.—Field-Horsetail (*Equisetum arvense*).

This hardy perennial is reproduced by spores, not seeds, and propagated by root-stock. The spore differs from seed inasmuch

as it contains no embryo, but, like seed, it is scattered, sown, and germinated on moist earth. Before scattering, the spores are contained in spore-bags; the bags are produced by special leaves, shaped like angular shields, and aggregated in a "spike" at the end of an aerial stem specialised for their production.

The propagating apparatus—root-stock—is very deeply placed in the ground, creeps so extensively, and branches so freely, that drains even are often choked thereby. Fibre-roots are produced in abundance along the creeping stock, and these absorb crude material from the depths of the soil. So crude is the material absorbed, and consequently so abundant is silica in the plant, that any part of the stem rubbed on the finger-nail acts as a fine file. In this respect horsetail is comparable to tufted hair-grass.

There is also a special apparatus for changing crude materials absorbed from soil and air into true horsetail food: this is the aerial green or barren stem.

The chief parts to be kept in view when eradication is attempted are: 1, root-stock; 2, barren stem.

The root-stock is too deep for the plough, and can only be got at indirectly by starving out. A plant may be starved in two ways:—

1. By preventing absorption of the necessary substances through the roots.
2. By overshadowing or removing the green parts, and thus preventing formation of root, stem, and leaf-making food.

The first is accomplished by so filling the surface-soil with roots that the necessary nitrates do not filter down to the drains and horsetail roots; the second, by occupying the surface with tall aerial vegetation, or by root crop under which the barren stems may be removed.

To prevent spore reproduction, the fertile stems must be taken in hand. These are produced in early spring, at the expense of food material stored in the root-stock, are destitute of green colour, unbranched, not taller than 6 inches, and are ready to scatter the spores by the month of April. When the spore-bearing stems have done their work, the green parts are coming forward. Horsetail in its mode of life closely resembles coltsfoot. These green stems are not taller than 2 feet, and are copiously branched, resembling a green bottle-brush. The branches are arranged in whorls, and spread at an angle of 45° with the main stem, giving the horsetail appearance embodied in the name of the weed. The leaves, excluding those which make spores, are degraded and very rudimentary, represented merely by toothed sheaths placed at intervals along all the stems. The work done in ordinary cases by green leaves must here devolve upon the aerial stem, hence extensive branch-

ing and green colour of the stem. This leaf peculiarity, and the absence of a seed-making apparatus or flower, are quite distinctive of horsetail.

Agricultural Peculiarities.—This perennial weed is confined entirely to wet land, and its roots penetrate so deeply that it is impossible to clear them out either by ploughing or any other tillage. Deep stirring and grubbing check the growth of the plant, and are therefore in some measure beneficial. The growth of heavy, green, and fodder crops helps to keep it down. The only effective remedy, however, is to thoroughly dry the land by sufficient drainage, and if this cannot be accomplished, the complete extirpation of the weed is hardly possible. It is a troublesome weed on cultivated land, and forms a still more objectionable constituent of pastures.

SECTION XXVII.—TABLE OF WEEDS (DESCRIBED IN PART II.)

SECTION.	NAME.	HABITAT.	FLOWER COLOUR.	COMMENCEMENT OF FLOWERING.	DURATION.	REMARKS.
VIII.	BUTTERCUPS	Damp land	Yellow	..	Perennial	Poisonous.
1.	Erect B.	Low damp meadows	"	June	"	Flower-stalk not ribbed.
2.	Running B.	Hedge-banks and pasture	"	May	"	" ribbed.
3.	Bulbous B.	Dry pastures	"	"	"	Calyx reflex.
IX.	POPPIES	Corn	..	May	Annual	Poisonous milky juice.
1.	Red P.	On light soil	Scarlet	"	"	Spreading hair on flower-stalk.
2.	Long smooth-headed P.	Indicates heavy land	"	"	"	Seed-box elongated, not bristly.
3.	Long rough-headed P.	On light soil	Pale red	"	"	Petals remarkably narrow.
4.	Common Fumitory P.	On sandy fields everywhere	Very small, pale purple	"	"	Deficient in skeleton and tending to be prostrate.
X.	CRUCIFEROUS WEEDS	..	..	..	..	Four petals arranged as a cross.
1.	*Charlocks*	Corn and waste land	Yellow	..	Annual	Suffer from finger-and-toe.
a.	Common C.	"	"	May	"	Part sown is a seed.
b.	Jointed C. or Runch	"	Pale yellow, with violet veins	June	"	Part sown is a pod-joint containing a seed.
2.	*Bitter Cresses*	Wet pastures and meadows	White or lilac	April	Perennial	Leaf pinnate; long narrow seed-box.
3.	*Shepherd's Purse*	Corn, and everywhere in sandy fields	Small white	February	Annual	Seed-box flat and triangular.

TABLE OF WEEDS—*continued.*

SECTION.	NAME.	HABITAT.	FLOWER COLOUR.	COMMENCEMENT OF FLOWERING.	DURATION.	REMARKS.
XI.	CHICKWEED FAMILY	..	..	..	..	Leaves simple and opposite; stem with swollen nodes.
1.	*Chickweeds*	Fields	White	Spring	Annual	Very small flowers
a.	Common C.	"	"	March	"	Line of hair along the stem; prostrate.
b.	Mouse-ear C.	Dry fields and pasture	"	April	"	Whole skin downy; leaf very narrow.
2.	*Spurrey*	Light sandy soils, among roots and corn	"	June	"	Of prostrate habit; leaves cylindrical not flat, apparently in whorls.
3.	*Campions*	..	..	..	..	Flowers comparatively large.
a.	Bladder C.	Calcareous pastures	"	June	Perennial	Waxy skin; calyx puffed, with a network of veins.
b.	White C.	Dry fields and pastures	"	"	"	White flowers and hairy skin.
c.	Red C.	Damp meadows and pastures	Red	"	"	Red flowers and hairy skin.
d	Ragged C. or Ragged Robin	Moist meadows	Rose	May	"	Ragged petals.
e.	Corn C. or Corn-cockle	Corn	Pale purple	July	Annual	Calyx longer than corolla.
XII.	SILVER-WEED	Poor wet land with clay subsoil	Yellow	June	Perennial	Running habit; flower like buttercup; leaf silvery, like tansy; no aerial stem.
XIII.	COMPOSITES	..	..	..	..	Flowers aggregated into heads.
1.	*Thistles*	..	..	..	..	Leaves prickly.
a.	Corn T.	Corn and field borders on good loams	Purple	July	Perennial	Creeping root-stock; stem without prickly wings.
b.	Spear T.	Waste ground	"	"	Biennial	Large prickly heads; stem with prickly wings.
c.	Common Sow T.	On clays, corn, and waste ground	Yellow, pale	June	Annual	Heads small and numerous.
d.	Corn Sow T.	Corn	" bright	August	Perennial	Creeping root-stock; sticky hairs on outside of head.

2.	*Burdock*	Hedge-bank and fields	Purple	July	Biennial	Large leaves and hooked heads.
3.	*Knapweeds*	..	..	..	..	Heads like a dark knob.
a.	Corn K. or Corn-flower	Corn on sandy soil	Blue	June	Annual	..
b.	Black K. or Hard-head	Meadows and roadsides	Purple	"	Perennial	..
4.	*Ox-eyes*	..	..	..	..	Leaves not finely divided.
a.	Yellow O. or Corn Marigold	Corn on land with clay subsoil	Yellow ray and yellow eye	June	Annual	Waxy skin.
b.	White O. or Marguerite	Pasture indicating poverty	White ray and yellow eye	"	Perennial	..
5.	*Daisy*	Poor pasture	"	January	"	No aerial leafy stem.
6.	*Chamomiles or Horse-gowans*	Light fields and waste land	"	..	Annual	Leaves finely divided; yellow eye, not flat but prominent.
a.	Corn C.	Corn	"	June	..	Bald-skinned; scented when bruised; chaff among the flowers.
b.	Scentless C. or May-weed	Corn and waste ground	"	"	Annual	Not scented; no chaff.
7.	*Coltsfoot*	A typical wet clay weed	Yellow	March	Perennial	Leaf large like a horse's hoof; lower surface with a blanket of down.
8.	*Ragweed*	Grass and roadsides on light land	"	July	"	..
a.	Groundsel	Gardens and fields	"	January	Annual	..
9.	*Milky-juiced Composites*	..	..	..	..	With milky juice like sow-thistles.
a.	Common Dandelion	Pasture everywhere	Yellow	March	Perennial	Bald skin.
b.	Rough Hawkbit	Pasture	"	June	"	Hairy skin.
c.	Autumnal Hawkbit	"	"	August	"	Flower-stalk branched; no chaff among the flowers.
d.	Long-rooted Cat's-ear	Pasture and roadsides	"	July	"	Flower-stalk branched; chaff among the flowers.
e	Nipplewort	Fields and waste ground; on clays chiefly	"	"	Annual	An aerial leafy stem; heads numerous and small; seed-apparatus not wind-sown, and without hair crown.
XIV.	TWINERS	Corn	..	..	..	The stem is the twining organ.
1.	*Bindweed*	..	..	..	..	..
a.	Small B.	Corn-fields on light land	Pink	June	Perennial	Flowers large.
b.	Black B.	Corn on heavy land	Green	July	Annual	Flowers inconspicuous; leaf with an *ochrea*.
2.	*Clover-Dodder*	Clover parasite	Yellowish pink	August	"	Thread-like stem; no green leaves.

TABLE OF WEEDS—*continued.*

SECTION.	NAME.	HABITAT.	FLOWER COLOUR.	COMMENCEMENT OF FLOWERING.	DURATION.	REMARKS.
XV.	LEAF-CLIMBERS	Corn	..	..	..	Leaf-tendrils are the climbing organs.
	Hairy Tare	On porous sandy soils and waste ground	Pale blue	June	Annual	..
XVI.	HOOK-CLIMBERS	Corn	..	..	..	Hooked hairs are the climbing organs.
	Cleavers	Corn-fields and hedges	Small white	June	Annual	Leaves in whorls and narrow.
XVII.	YELLOW RATTLE	Damp meadows and pastures	Yellow	May	Annual	Leaves opposite; flower two-lipped; seed winged and flat.
XVIII.	SELF-HEAL	Poor moist meadows and pasture	Violet	July	Perennial	Stem square; leaves opposite; four seed-apparatuses per flower.
XIX.	DOCK FAMILY	..	..	..	..	An *ochrea* present.
1.	*Broad-leaved Dock*	A clay weed among grass and on waste ground	Reddish green	July	Perennial	Leaf large and broad.
2.	*Sheep's Sorrel*	Sour grass-land with clay subsoil, and on gravels	Reddish	May	"	Leaf sour, with spreading ears.
3.	*Knot-grass*	Fields and waste land, or clays and gravels	Variable	July	Annual	Prostrate in the open; leaf narrow; flower clusters without shank.
4.	*Redshank*	Dunged crops and waste grounds	Greenish rose	"	"	Leaf with a black blotch; seed-apparatus flat not triangular.

XX.	MELD-WEEDS	Dunged fields and on dung	..	..	Annual	Skin with mealy hairs.
1.	White M. or Goosefoot	Waste ground	Greenish	July	"	Leaf like a goose-foot; rhombic.
2.	Spreading M. or Orache	"	"	"	"	Leaf like a triangle; seed-box with a two-valved investment.
XXI.	RIB-GRASSES	Meadow and pasture	..	..	..	No aerial leafy stem; leaf or ribs prominent, parallel to the margin.
1.	Common R.	Pasture	Green	June	Perennial	Narrow leaf like grass.
2.	Greater R.	"	"	"	"	Broad leaf.
XXII.	WEED-OATS	Corn-fields	..	..	Annual	..
1.	Black Oat or Bristle Oat	"	..	July	"	..
2.	Wild Oat or Haver	"	..	June	"	..
XXIII.	BROME or GOOSE GRASSES	On light land	..	..	Annual	Heavy branched ear; leaf-sheath unsplit.
1.	Rye B.	Corn-fields	..	July	..	Bald-skinned.
2.	Soft B. or Goose-grass	Fields and roadsides	..	May	Annual	Downy-skinned.
XXIV.	BULBOUS OAT-GRASS	Fields and roadsides on light land	..	June	Perennial	Herbage bitter-tasted.
XXV.	COUCH-GRASS	On light sandy fields and roadsides	..	June	Perennial	Of underground creeping habit; eared leaf-base; ligule scarcely visible.
XXVI.	FIELD-HORSETAIL	Corn and fields in want of drainage	..	April (no flowers nor seed, but spores).	Perennial	No leaves; green leafless stem like a bottle-brush; an underground creeper.

SHETLAND PONIES.

By R. Brydon, Seaham Harbour.

The native home of the Shetland pony, or "Sheltie," as it is more familiarly called, is the group of islands which constitute the northern division of the county of Orkney and Zetland. These islands extend from latitude 59° 51′ to 60° 50′ north, and lie between longitude 0° 40′ and 1° 50′ west.

From a picturesque point of view Shetland possesses many beauties, but in an agricultural sense it is a poor county. Except in certain favoured localities the vegetation is of the scantiest description.

Climate.

Owing probably to the influence of the Gulf Stream the average winter temperature is higher than in Scotland, but the summers are colder. The rainfall averages 37.71. During a short period in summer, when it is light all through the night, growth is extremely rapid, and throughout the autumn and early winter there is usually plenty of food for farm stock. Spring, however, is, as a rule, a very trying time, and if the native breeds of stock were not of the hardiest description it would be impossible for them to survive the vicissitudes of this period.

Early History of the Shetland Pony.

For those who would know it fully, I strongly recommend the perusal of the able article on the subject by Mr J. M. Goudie of Lerwick, published in vol. i. of the 'Shetland Pony Stud-Book.' Here I would merely state that while, formerly, it was a common belief that the ponies were introduced by the Norsemen who invaded Shetland towards the end of the ninth century, it is now pretty clearly established that horses were known and used by the earlier Celtic inhabitants long previous to the Norwegian invasion.

Description and Properties.

The most notable characteristics of the breed are small size combined with strength, fine symmetry, and an absolute freedom from the hereditary diseases incident to most other breeds of horses.

In the article already alluded to Mr Goudie writes as follows:—

"These diminutive horses have always been remarkable for the wonderful amount of strength they possess, considering their small size, and the great amount of fatigue they are capable of enduring.

"Their hardihood and sure-footedness may be accounted for by the manner of their life, and probably to the same cause may be ascribed their sagacity, spirit, and activity.

"Though left untamed, and perhaps unhandled for years, these sharp little animals are easily tamed and rendered docile, and under kindly treatment show no signs of vice.

"The Shetland pony is the most lovable of animals in the wide creation.

"To see it at its best, it should be seen with its foot on its native heath, unencumbered with shoes, grazing and roaming wild over the breezy hills.

"They are sprightly and active as terriers, sure-footed as mules, and patient as donkeys.

"The horse is accredited as the noblest of the lower animals, and the Shetland pony stands at the head of this noblest race, as the most intelligent and faithful of them all."

Improvement.—The above refers to the ponies at their best. It goes without saying that they are not all alike. They both can and have been vastly improved by careful breeding and selection, and with the opposite treatment they are equally sure to degenerate.

Colour.—Black is the prevailing colour, but browns, bays, duns, chestnuts, and piebalds are quite common. The two latter colours are not so much in request, and by careful mating can easily be got rid of.

Size.—In size they usually range from 9 to 11 hands. When care and selection are exercised in the breeding, the average will not exceed 9½ hands; but in ordinary circumstances, where indiscriminate mating is permitted, they will average 10½ hands.

Breeding and Management in Shetland.

About four-fifths of the entire number of ponies in Shetland belong to the crofters. Each crofter owns, at least, one or two mares, while some have five or six.

These they use for breeding purposes, and for carrying home the peat in summer. Their system of management is as follows:—

Ponies are never housed, but run out all the year round—on the common or scathold in summer, and on the "intoon" land in winter. When food fails on the hills they come to the sea-shore and, following the ebb of the tide, eat the drift-ware. When the ground is covered with snow they approach the

houses, and in most cases get a sheaf of corn; but, except in such circumstances, they have to search for their food and shelter.

In spring, they often become extremely low in condition, and do not recover their strength until June. They also get covered with a thick coat of matted hair, which peals off as summer approaches, the last of it hanging in tatters as late as July.

Foals.—The crofters' mares, as a rule, breed a foal only once in two years. This is due to the prevailing custom of not weaning the foals, but allowing them to go with their dams all winter. This is done because it is found that the foals are much easier wintered under such circumstances, yet the indirect loss is much greater than the gain.

Scarcity of Stallions.—In some districts also the scarcity of stallions has no doubt been the cause of many mares being barren.

Before the great demand set in for Shetland ponies for the mining districts, there were always plenty of stallions running on the scathold, and the crofters trusted to their mares being served by these. Now, however, every saleable horse is sold, and there would be no stallions available if it were not for proprietors, merchants, and other men of capital interested in Shetland. In particular, I may mention the Earl of Zetland; Mr Bruce of Sumburgh; Messrs Anderson, Hillswick; and Messrs Sandison, Uya Sound—all of whom have spent considerable sums in procuring good pedigree stallions. It is to be hoped this noble example will be widely followed, and that many other districts will yet benefit from similar beneficence. If not, the crofters in the districts where the want is felt should combine, and either buy or hire pony stallions. They would thus secure what would be a great benefit to all, at a small cost to each.

Selling.—The crofters, as a rule, sell their horse-foals as yearlings, or as soon thereafter as they can get a merchant for them. The mares are less in demand, as they are not used in the pits —not that they are less capable, but solely on account of it being impossible, without much trouble and loss of work, to have mares and stallions working alongside one another in such limited space as is available in a coal-mine. In late years, however, a very large number of mares have been bought up for founding studs in the south, and for exportation to America.

System of Management in large Studs.

This differs in several important details from that pursued by the crofters.

Lord Londonderry's Stud.—A sufficient illustration of this

may be given by describing the system adopted in Lord Londonderry's stud in Bressay and Noss, which is by far the largest in Shetland.

The stud was formed in 1873, and the greatest care has been exercised ever since in selection and mating. The objects aimed at were—1st, reduction in size without loss of strength; 2d, increase of bone; 3d, improvement of action; 4th, better shoulders; 5th, smaller head; and 6th, more uniformity of type.

A considerable amount of success in all these directions has been attained. This is not to be wondered at, as neither trouble

Shetland Pony Stallion, Young Viscount (48). Bred by the Marquis of Londonderry.

nor expense has been spared in attaining the end desired, throughout the twenty years which have elapsed. In this connection it is only right to mention that much credit is due to Mr John Meiklejohn, who was the resident manager of the farm for nearly the whole of the above period.

The *mares* are classed in the month of May, and put into lots of from ten to fifteen each, each lot being turned into a separate enclosure along with a stallion specially selected to suit them.

Foals.—The foals are weaned early in November, and put on good pasture which has been saved for the purpose. They receive hay as soon as the state of the weather renders this

necessary, and they have the benefit of a shelter-shed, into which they can run out and in at will. They require more care in the first year than in any other period of their existence.

Young Stock.—The next year the young horse and mare ponies run on the hills, and seldom require any hand-feeding, except when the ground is covered with snow.

Mares.—The brood-mares are kept on old pasture, and when they can get on the sea-shore eat a lot of sea-weed. During snowstorms early in the season, and in the late spring, whether there are snowstorms or not, they require a little hand-feeding.

The mares are annually overhauled. Any animals with the slightest defect are sold, and the best young ones are put in their place. In this way the high character of the stud is maintained.

Horse-ponies are usually sent south when two and a half years old, except a few of the choicer specimens, which are retained for breeding purposes.

Crossing.

Several attempts have been made to improve the Shetland pony by crossing with other breeds. Size has of course been gained, but this at the expense of symmetry and hardihood.

Where there are good roads, the desire of the crofters for a wheeled conveyance has induced them to mate their ponies with larger animals, and although the result is the attainment of the end desired, the ponies so bred have lost many of the best characteristics of the breed,—in particular, they require to be housed and fed like their South Country brethren during winter. The chief districts where these cross-bred ponies prevail are the vicinities of Lerwick, Scalloway, and Dunrossness.

Arab Cross.—In the island of Fetlar the late Sir Arthur Nicholson introduced an Arab stallion, about forty-five years ago. This animal was the property of a cavalry officer, who refused to sell it, but gave it to Sir Arthur on condition that it should get a comfortable home. It was used for crossing the native ponies; but on the whole the experiment cannot be designated a conspicuous success. The ponies so bred are much taller; but they are neither improved in symmetry nor in action, and being very much less hardy, are more expensive to keep. When they come to be sold they do not command the price that is readily obtained for good specimens of the native breed.

Employment.

About 90 per cent of the Shetland ponies exported from Shetland are used for one or other of two purposes:—

1. Work in the coal-mines.
2. For carrying and drawing children.

In both capacities they are unequalled by any other breed.

Pit-Ponies.—So far as work in the coal-mines is concerned, their superiority over other breeds consists in their great relative strength to size.

The Shetland pony is decidedly the smallest European type of horse, and it can therefore be used in thin seams where larger ponies could not travel on account of the lowness of the roof.

The small size would not be of so much advantage if accompanied by a corresponding decrease in strength. This, however, is not so; for though shorter in the leg than any other kind, it is at the same time wider in the body and shorter in the back, with larger bones, thighs, and arms, and is therefore comparatively stronger than, and able to do with ease as much work as, average ponies of other breeds a hand higher.

Its docile temperament enables it to be trained for pit-work in almost as many days as it takes weeks with Welsh ponies. It becomes quickly accustomed to its new surroundings, and I cannot recall a single instance where a Shetland pony had to be withdrawn from pits for being wicked or unmanageable—a very frequent occurrence with some breeds.

As a rule, too, it lasts longer, and is seldom removed from the pits except for old age or through accident.

Amount of Work in Pits.—To give an idea of the work done by a pit-pony, it is not overstating the case to say that on an average they will travel over 3000 miles in the course of a year, and "shift" as many tons of coal. This is no mean performance when we consider that the work is done in the black darkness of a coal-mine by a pony 38 to 40 inches high working in a place very little higher than itself. The amount of work varies in different collieries. In level pits much more can be accomplished than where the gradients are steep.

Treatment in Pits.—The lot of a pit-pony is certainly a hard one, but it is not by any means the dreadful existence that many people suppose. Their work is hard, but they are well fed, and the equable temperature of the coal-mine keeps them singularly free from all catarrhal affections so common in animals which have to stand the vicissitudes of our British climate. As a rule, their coats are sleek and their condition such as any one with a stud of hunters would envy.

There is a popular belief that ponies kept in coal-mines soon

go blind. This is not so; but loss of sight is not infrequent as the result of accidental injury, to which ponies working in dark passages are very liable.

That they are occasionally badly used goes without saying; but generally the Shetland pony, from its tractable disposition, is a favourite with its driver, the putter-boy, from whom, as a rule, it receives, if rough, at least not unkind treatment.

Ponies for Children.—As ponies for children the Shetland "Shelties" stand pre-eminent. No breed can equal them for this purpose. They are quiet, tractable, sure-footed, and trustworthy. Since the days of the Trojans the advice "*Ne credite equo*" has been accepted as sound, and perhaps the Shetland is the only breed that can be always trusted. Of course they may be spoiled. Apt pupils as they are, mischief can be taught them; but without teaching they are never "tricky."

The intelligence and good-nature of Shetland ponies soon gain for them the confidence of children, and they become companions and pets, equally willing to draw a carriage, carry panniers or saddle, or be led with a rein.

In teaching young children to ride or drive, no greater mistake can be made than to trust them with an animal that will take advantage of their inexperience. The confidence of a child should never be shaken, and a tricky pony is certain some day to cause an accident, which, even if not accompanied by any serious injury, destroys this confidence. While the Shetland is not tricky, it certainly is not stupid, and is never wanting in courage.

A strange fad has lately been promulgated—viz., that children should ride narrow ponies, as the wide-backed ones are apt to cause ruptures. This is an absurd error. My experience of Shetland ponies is very large, and nearly all our training is done by boys, some of whom do little else for years except ride them, and I have never known a single case of any form of rupture in these lads.

Prices.

It is stated by Captain Preston that in 1743 the current price of a pony was one guinea. Prices in 1774 are said to have ranged from £1 to £2, 10s.

Shetland ponies were first used in the Durham coal-mines in 1847, and as soon as their value for this work was fully appreciated the price rose rapidly.

In 1851 Mr Hunting, South Hetton, bought thirty Shetland horse-ponies, four, five, and six years old, for the South Hetton and East Hetton Collieries at £4, 10s. per head. About 1867 good ones could not be got at less than £10.

Shortly after this the great period of prosperity in the coal trade set in, and almost every available horse-pony in Shetland was bought up and taken to the mining districts; till in the years 1872, 1873, and 1874 yearlings only were obtainable, and these for a time sold freely at from £11 to £13 each.

Since then, owing to the decline in the price of coal, ponies have again become more plentiful. Still, good ones, of a small size and age suitable for immediate work, command satisfactory prices.

The following table gives the average price obtained at the different Londonderry sales held at Seaham Harbour since 1875:—

Year.	Month.	No. sold.	Average price.			Year.	Month.	No. sold.	Average price.		
			£	s.	d.				£	s.	d.
1875	November	50	21	11	11	1886	April	30	22	11	6
1876	September	57	26	10	3	1887	April	30	21	8	9
1877	October	25	23	3	3	1888	April	25	22	3	11
1878	October	30	24	19	5	1889	March	22	21	13	4
1879	October	34	20	3	0	1890	April	43	28	8	11
1881	March	40	20	17	1	1891	April	33	28	7	7
1881	November	30	20	6	3	1891*	October	30	27	3	10
1882	March	47	19	0	11½	1892	April	31	23	5	5
1883	March	44	20	15	11	1893	February	48	24	9	8
1884	April	25	22	17	5	1893	April	26	20	14	2
1885	April	26	23	19	9	1893	October	21	24	16	0

Pedigree ponies, for show and breeding purposes, command much higher prices, but the demand is not extensive.

Size and Price.—It may also be stated that the price is a good deal governed by the size—the smaller the pony, *cæteris paribus*, the more money he is worth; and the demand for diminutive specimens has greatly increased since the establishment of the Stud-Book, which limits the height of those admissible for entrance to 10.2 and under. This is a most salutary regulation, as previously there was great danger of their becoming too big. If the breed is kept small, they have the market, for the mines where thin seams prevail, entirely to themselves. Directly 10.2 hands high is exceeded, they come into competition with Welsh and other breeds, and the price suffers accordingly.

I think the height which ought to be aimed at is from 38 to 40 inches. When much below this height they are no doubt curiosities, but are not, so far as I am aware, adapted for any useful purpose.

South Country Studs.

Thinking it would be interesting to know if owners of South Country studs were experiencing any difficulty in keeping down the size, I wrote to a few of the most prominent, and herewith give their replies.

Mr A. M'Farlane, Kingussie, writes: "I consider that in our climate Shetland ponies can be bred as small as in the islands of Shetland. The pasture which I give them is rough meadow-land, and there I leave them summer and winter, and I find they keep their condition very well indeed; and although I have a shed erected for them on a rough day, it is very seldom they go into it. I think they can be reared in this part of the country equally as well as in Shetland. The Shetland pony is, I consider, the smartest creature you can put into harness. I broke in one little mare which I had. She was 39 inches high, and in the little trap which I had built for her she could trot ten miles an hour. I think any gentleman having a piece of waste land should go in for a few of them. They prove to be a very attractive, and, I think, a paying concern."

The Ladies Hope, Chertsey, Surrey, write: "We have found, so far, that Shetland ponies thrive very well in the South, and live out summer and winter with no extra feed but a little hay if the weather is very severe. No corn is given till the ponies are four years old, for fear of increasing the size. It is very difficult to keep them down to 36 inches in height, as the tendency, so far, has been for the foals from extra small parents to be comparatively large at birth, and when this is the case they make ponies 38 or 39 inches high. This is probably owing to the fact that the very small ponies are only so by accident, and the foals throw back to their larger grandparents. Perhaps this difficulty could be overcome by careful selection, especially now there is a Stud-Book. We have not found the larger-sized ponies, 38 to 40 inches, so likely to increase in size in the next generation, if they are not forced. Some of the ponies, when kept in the stable and well fed, are very fast trotters for their size. One little mare, Hoplemuroma, No. 130, though only 35½ inches high, has trotted on different occasions four miles in fifteen minutes, seven miles in twenty-nine minutes, and nine miles in forty-three minutes, drawing one person, about 9 stones—the time being carefully taken on each occasion."

Mr N. Clark, Beamish Park, Chester-le-Street, writes: "The stud of Shetlands of which I have the charge was started in 1866, with twelve mares and a stallion. They were put upon a place, partly heather, the rest poor grass, at an altitude of 800 feet, but some young fir plantations afforded them good shelter.

The large mares were weeded out, and nothing but the small, deep-sided, wide, short-legged mares were kept, and the smallest and best stallions which could be found were used. But, with all this care and selection, it has been difficult to breed ponies below 10 hands, and it is only by using such ponies as The Giant with the smallest mares (some not 9 hands) that a small percentage of 9- and 9½-hand ponies can be got. The foals do not bear the severe weather on the high ground, but after the first year they seem to be able to stand any kind of weather, and live without any hand-feeding, except when the ground is covered with snow—then they require a little hay. I account for the difficulty in breeding ponies under 9½ hands in two ways: 1st, I consider anything under 9.3 an abnormal height; and 2dly, our grass here, no matter how poor, makes the ponies fat, and consequently encourages growth. I never saw a fat pony come direct from the native Islands."

Mr Gavin Hadden, Dalmuinzie, Aberdeenshire, writes: "My mares are by Giant (10), and my present stud-pony is Multum in Parvo (28). Both Giant and Multum in Parvo were bred by the Marquis of Londonderry. Giant is an extremely small pony with large bones and great strength; Multum in Parvo, as indicated by his name, is also small, and may be considered a model of the breed, and has won several prizes at the Highland and other shows. I am so pleased with his produce that I intend to stamp his type permanently on the stud, and therefore have mated him with several of his own daughters. I find that my ponies have not increased in size, though my breeding experience extends to the third generation. This is no doubt to be attributed to the great care exercised in the selection and mating."

Mr Ranald Macdonald, who keeps a stud of Shetland ponies in South Uist, writes as follows: "They are kept mostly on heath, and have done well. As yet I have not found any tendency to increase in size, but I take care to exclude them from rich pastures. I believe that increasing size is the result of high feeding, no matter where the ponies are kept."

Mr R. W. R. Mackenzie of Earlshall, Leuchars, writes: "My first experience of Shetland ponies was at our farm at Huntingtowerfield, in Perthshire. I can testify to their hardiness, as they were left out there, summer and winter, without shelter of any sort, and seemed to prefer scraping the snow for their living to any hand-feeding. During some very severe weather I thought they would be better of shelter of some kind, but I never found them take kindly to it, and believe it was quite unnecessary. Only recently I acquired this property in Fife, where I have about 900 acres of very rough moorland, close to the sea. It is mostly covered with benty grass and

heather, and carries a good many rabbits. It is on this I intend to run a small stud of ponies, but of course it is as yet premature to say how the experiment will succeed."

The Rev. C. E. Barnes writes: "During the past nine years I have had many opportunities of observing the 'Shelties' in their southern home, and the following are a few opinions I have formed with regard to them. There is a tendency under certain circumstances to an increase in height. Ponies brought from the north as yearlings or two-year-olds, especially in the late spring or summer, are apt to grow very quickly. A horse-pony measuring 36 inches and rising three years, that I purchased two years ago in the spring, measured in the autumn of the same year 37¾ inches—*i.e.*, he grew in six months nearly 2 inches—and I also had very nearly the same result in the case of two mare-ponies. On the other hand, ponies bred in the south from known parents do not, as a rule, increase rapidly in height, although there may be a slight tendency to do so.

"As a rule, there is no reliance with regard to height to be placed in the produce of ponies of unknown origin. In my own stud the foal of a small mare purchased in the Islands was nearly as high as its dam by the end of a year, and this same dam, although crossed with a small sire, always has large foals. This must be attributed to breeding back. However, one seldom has the same result with known parents down to the second generation; beyond this I cannot speak from experience.

"Seven years ago I had the opportunity of seeing daily the largest stud of Shetland ponies in the south—I refer to the Marquis of Bristol's at Ickworth, Suffolk. Ponies have been bred there since the beginning of this century, or even earlier. Still, at the time I am writing of, 1884 to 1887, the ponies were increasing rapidly in height, but this was owing to the introduction of a large sire. I noticed the old brood-mares were small, about 40 to 42 inches. This would show that, in spite of plenty of grass, and under much brighter circumstances, if the ponies are carefully chosen at first, there is not a rapid increase in height. I may quote here a letter received from Mr G. H. W. Hervey, the agent to the Marquis of Bristol: 'My idea is that Shetland ponies always grow larger the further south they go. The present sire we have in use here is Rapid (vol. i. p. 51), a very small pony. I bought him at Lord Londonderry's sale, as I thought the stud was rather losing the characteristic of the Shetland, which should be a short-legged, stout animal. The stud has often been recruited with fresh blood from the Islands, both stallions and mares.'

"It will be seen from the above that the plan advocated by Mr Brydon, in the first volume of the 'Shetland Pony Stud-Book,' has been adopted in this stud, and with good results. At

present I have not seen any of the foals by Rapid, so cannot give the result. With regard to standing the winters, after the first year is over there is little or nothing to fear, but as foals they have to be nursed a little—in fact, hand-feeding I have always found necessary in the case of foals, also a shed to lie in at night. Shetland ponies will not stand the starvation *régime* advocated by many breeders. I mean keeping them on bare pasture, and no hand-feeding. Weedy and useless ponies are the result of this kind of treatment. The ponies always seem to look better when allowed to roam on large pastures, than when kept in small paddocks.

"For endurance and pluck Shetland ponies have no equal. I have often driven a small pair of ponies thirty-five miles in a day, taking them straight from the field before starting, and turning them into it again on my return. After a good roll they seem as fresh as ever, and eat the small measure of corn given to them in a way that would shame a larger horse, under the same circumstances.

"Although, as I have already said, there is a tendency to increase in height, I feel certain, if southern breeders choose their ponies carefully, and occasionally import a fresh pony or two from the Islands, there will be no great difficulty in keeping the ponies down to the height required by the Shetland Stud-Book."

Major Rooke, Aigburth, Liverpool, writes: "When I first commenced a stud, all I bought (which I obtained direct from the Islands) were two- and three-year-olds, and in no case did I find any of them grow higher than what would be expected if they had been allowed to come to proper development in the Islands."

Mr Jacob Vickers, of Frosterley, Weardale, Durham, writes: "I have formed a stud of pure-bred Shetland ponies, chiefly purchased from the stud of Lord Londonderry, at the Seaham Harbour sales. The ponies, all ages, are pastured upon an open fell on a hill farm in Weardale, about 1600 feet above the sea-level, with very little shelter except the ravines. The ponies find their own food, except in case of a severe snowstorm, when they get hay. The foals are taken from their dams in November to a warmer situation, and allowed hay during the winter. The in-foal mares, in April, are brought into a rough allotment, where they remain till foaled. A stallion from Lord Londonderry's stud is turned to them from June to August, and in this way about 70 per cent of the mares prove in foal. With better keep and warmer climate, the tendency is to increase in size. This difficulty may to some extent be obviated by the judicious selection of small-sized mares and stallions; also keeping well in view stout strong-boned ponies.

In-and-in breeding tends towards diminution of size, but should not be followed, owing to the danger of causing infertility in the mares, also developing constitutional weaknesses; but I should rather follow upon line-breeding, mating together ponies of the same line of descent, but not closely related. By this means, with rigorous selections, ponies may be bred true to type; while, at the same time, the evil consequences of close in-breeding are avoided."

Sir James Duke, Bart. of Laughton, Sussex, writes: "The Shetland ponies which I have now are entirely kept in the lowlands. I find that they stand any amount of cold and snow, but excessive wet, on the wet land here, does not seem to agree with them. I have not experienced so much trouble as I anticipated in keeping down the size, as I have always used a small stallion from small parents, and by judiciously in-breeding I have got rid of, to a great extent, a tendency to increase in size."

Mr C. Macpherson Grant of Drumduan, Forres, writes: "I keep my ponies on about 30 acres of grass-land of poor quality, resting on sand and gravel, 5 acres of which is well manured and top-dressed to grow hay for winter keep. The ponies get no hard feeding up to January 1; after that they get one turnip per head per day, and hay at night, but as soon as the grass begins to spring they will not touch the hay.

"Hitherto I have not experienced much trouble in keeping down the size, but I attribute this to careful selection in mating.

"Young Viscount (48) [bred by Lord Londonderry] was stud-horse for many seasons, and was most successful in leaving small stock with large bones. He is now succeeded by Harold (also bred by Lord Londonderry), which won first and champion at the Highland Show at Inverness in 1892, and first and champion at the Aberdeen Show, 1893. Harold is by Laird of Noss (20), dam Fra by Prince of Thule (36), so he inherits the best of blood."

Young Viscount is represented in the illustration, p. 73.

Mr Robert Wood, manager to Messrs Hedley Brothers, at Holmside Old Hall, county of Durham, writes: "This stud was formed in 1882. The stallions have chiefly been purchased at the Londonderry sales, and were selected with great care. Messrs Hedley have been very fortunate in breeding. In 1892, twenty-two ponies produced nineteen foals, and in 1893 twenty-six produced twenty-three foals. They have not experienced any difficulty in keeping down the size. None of the colts are allowed under cover, but the in-foal mares have a shed to run in if they like. Except in severe weather, when they get hay, no extra keep is given. The foals require to be carefully looked after the first year."

Mr George Bruce, hon. secretary of the Shetland Pony Stud-

Book Society, writes: "I have been breeding Shetland ponies for a good many years, first on a farm near Aberdeen, and latterly at Tochineal, Cullen. My stallion pony is Paris, purchased from the Marquis of Londonderry, and the winner of the Medal at the Paris Exhibition, and also Silver Medal at the Royal Northern Show at Aberdeen. My experience is, these ponies grow too big on ordinary land, but do well on rough exposed pasture or woodland. There is much of this class of land on the north-east coast of Scotland rented at from 1s. to 2s. 6d. per acre, and on it pony-breeding would pay very well; in fact the Shetland pony can live and thrive where sheep or cattle would starve. These ponies could easily be bred in Banffshire at paying prices."

Mr W. L. Bell, Southampton, writes: "My experience is that ponies bred in Shetland and brought south when but a few months old have not at all outgrown the size of their parents as represented to me; and I do not believe, if you breed in the south from the right type of pony (short-legged, wide-chested, short-backed, &c.), there is any likelihood of the progeny exceeding the height of the parents."

Summarised, the general opinion among breeders is that no difficulty is experienced in keeping down the size of Shetland ponies, if the following conditions are observed:—

1. Mate only small mares with small stallions, taking care that these are not small by accident, but that they have been bred from small stock.
2. Keep the ponies on poor pasture, with as little extra feed as possible.

THE EFFECT OF FOODS ON MILK-PRODUCE.

By John Speir, Newton Farm, Glasgow.

For many years I have been annually in the habit of making comparative tests of various foods on the milk of cows, principally in regard to their effect on the amount of milk produced by their use.

Occasionally the amount of butter which was yielded by the milk was calculated by churning small portions in a Speedwell crystal churn, and at other times by Messrs Watson & Laidlaw's centrifugal cream-tester. For everyday work the former was too slow, and the latter I did not like for various reasons.

Both of these systems of testing milk showed me that either the results I was obtaining were not accurate in regard to

quality, or else my experience in regard to the production of fat in milk by the use of various foods did not correspond with popular ideas.

As two machines by which the actual fat in milk could be speedily and accurately tested had now come into the market, I purposed to provide myself with one of them, and set about testing a number of foods during the summer of 1892. Having seen both the Leffmann-Beam and Babcock machines, and had a trial of each, I selected the former, and have pleasure in saying that it has given me every satisfaction.

In trying these two machines on the same samples of milk, it was found that they both gave identical results—with this difference, however, that the Babcock has the bottles graduated so as to show the amount of butter which may be produced, while the Leffmann-Beam gives the total fat in the milk.

Pasture.

In May four cows which had calved at different dates, and which were of various ages, were set aside for this purpose, and from the middle of May till the middle of June they were going in the fields, and during that time they received nothing but PASTURE. The idea was to feed them on, as near as possible, one particular kind of food for a month, as it was thought that if the particular foods were likely to exercise any effect on the quantity or quality of the milk, it would show itself during the last fortnight, if not before that. By putting the cows a month at least on pasture before beginning the experiment, and weighing and testing it daily for the last week, it was considered that a basis would be obtained for calculating the value of the other foods.

All the cows were milked by Murchland's mechanical milking apparatus, this being the third season during which Nos. I. and II. had been milked in that way, and the second season for No. III., while it was the first year for No. IV.

The milk was weighed and sampled only in the evening, there being more time and convenience for doing so then than in the morning; and the daily weight of milk is calculated as being the double of what was given at night. In the same way the fat in the milk has been calculated only on the milk of the evening. On that account it doubtless shows a fully higher percentage of fat than it would have done had the milk been sampled both in the morning and evening. As, however, all lots were done in the same way, the relationship of the one to the other is in no way disturbed.

In order to have the samples of the milk as accurately drawn as possible, they were taken from the can as soon as milked by

dipping into the milk a narrow glass tube open at both ends. This tube, when closed at the top by the thumb or finger, allowed a section of the milk from the top to the bottom to be lifted out and transferred to the sample-bottle. As a rule, from three to four sections were in this way taken from each can every night. Four glass-stoppered bottles were provided, and numbered the same as the cows, into which the samples of each cow's milk were put every night. From three to five grains of bichromate of potash were put into each bottle at the beginning of every week, which had the effect of thoroughly preserving it till the end of the week, when the composite sample was tested.

For some weeks at first, duplicate tests of each cow's milk were made every night, besides putting a sample in the composite sample-bottle, until it was definitely proved that the average of those tested separately was, practically speaking, identical with that of the composite sample.

The following is the result of the week beginning with 25th June and ending with 1st July, which is a fair average of the others tested :—

Cow.	25th.	26th.	27th.	28th.	29th.	30th.	1st.	Average.	Composite Sample.
I.	5.3	3.5	3.6	4.7	3.1	4.5	3.5	4.03	3.9
II.	5.1	4.2	4.7	4.2	4.4	4.1	4.6	4.47	4.6
III.	1.4	3.5	3.3	3.7	3.4	4.1	2.5	3.13	3.2
IV.	3.4	3.3	2.3	3.1	2.8	3.5	2.6	3.	31.

This week has been selected because it shows fully more than any of the others those daily variations to which the milk of every cow is subject, which makes the test all the more severe; yet in spite of these extreme variations, the two results vary comparatively little, the greatest being little over $\frac{1}{10}$ of 1 per cent. It is interesting to note the wide variations of even a single cow in one week, and in this case No. III. has ranged from 1.4 to 4.1 within that time.

The composite weekly samples were always tested in duplicate, and on every occasion on which they varied more than $\frac{1}{10}$ of 1 per cent, other two samples were taken. Before drawing the samples from the composite bottles, the milk was poured from one vessel to another at least half-a-dozen times, as only by doing so can the duplicate samples be made to agree.

At the beginning of the experiment, cow No. I. had been calved about one month, No. III. about two or three months, and Nos. III. and IV. something longer. During the last week on pasture they yielded the following weights of milk, having an average composition as follows:—

	No. I.	No. II.	No. III.	No. IV.
Milk, in lb. . . .	34.	22.6	34.2	28.8
Fat, in per cent . .	4.	4.8	3.2	3.7

Cow No. I. is the animal called No. 33 in the paper on the Mechanical Milking Apparatus in the 'Transactions' for 1892, and No. II. is the animal called heifer No. XI. in the same paper, so that those interested in their performance then and now may, if they desire, compare the results.

Vetches.

In anticipation of this experiment, a piece of land had been sown in the spring, at various dates, with *vetches*, so that during the continuance of the test the crop would always be in good succulent condition. On the 19th June the cows were shut up in the house and fed on vetches alone, each animal being given as many as it could eat, no note being, however, taken of the quantity eaten by each. While being fed on vetches the cows gave the following average weight of milk daily:—

	No. I.	No. II.	No. III.	No. IV.
	lb.	lb.	lb.	lb.
Last week on pasture . .	34.	22.6	34.2	28.8
1st week on vetches . .	30.	18.6	28.6	26.4
2d " " . .	31.4	16.2	31.2	30.
3d " " . .	30.2	18.4	30.	28.
4th " " . .	31.4	17.6	26.4	29.
Average for last two weeks .	30.8	18.	28.2	28.5

Vetches are considered one of the best possible class of foods on which to feed cows in milk, and if in good condition they are usually very fond of them.

Cows are at all times very sensitive to any change of food, and although it is for the better, they very often fall off in their milk for a week or so at first. Even with such a succulent food as vetches they did so in this case, and only one of them afterwards came up to the quantity they had been yielding when going on the pasture, which at that time was also very plentiful and succulent. They might also drop a little owing to being shut up in the house, as they evidently wearied considerably at first. The quality of milk yielded when being fed solely on vetches was as under:—

	No. I.	No. II.	No. III.	No. IV.
	Per cent of fat.	Per cent of fat.	Per cent of fat.	Per cent of fat.
Last week on pasture . .	4.	4.8	3.2	3.7
1st week on vetches . .	3.5	4.4	4.2	3.
2d " " . .	3.9	4.6	3.2	3.1
3d " " . .	3.75	4.52	3.42	3.35
4th " " . .	3.7	4.05	3.17	3.05
Average of last two weeks .	3.72	4.28	3.29	3.20

It was no great disappointment to find that the quantity of milk was not kept up on the vetches, but it was a sharp disappointment to find that the quality also fell, as that was not expected.

Cow No. III. fell off more than any of the others in her weight of milk during the first week, but she increased about 25 per cent in quality; so that while on pasture her milk would yield daily about $\frac{4}{5}$ lb. of pure butter-fat, it would yield daily about $1\frac{1}{5}$ lb. during the first week she was fed on vetches. By the next week, however, she had fallen back to her normal.

It is also worthy of notice that all the cows had milk of a lower percentage of fat during the fourth week than the one previous.

Sewage Meadow.

A piece of a *sewage meadow* had been ploughed up during the winter and been resown with *Italian ryegrass*, and at the middle of July it was yielding a heavy cut of very succulent grass. It was therefore decided to feed this crop to the cows, and note its effect on the quantity of milk produced, and percentage of butter-fat, compared with that yielded by the cows when fed on vetches and pasture. On 16th July, therefore, the cows were supplied with this Italian in such quantities as they cared to eat, and during the following month they yielded the undernoted weights of milk:—

	No. I. lb.	No. II. lb.	No. III. lb.	No. IV. lb.
Average of previous two weeks on vetches	30.8	18.	28.2	28.5
1st week on sewage Italian	31.4	18.4	29.6	28.
2d " "	30.4	16.8	30.	27.6
3d " "	29.2	15.6	27.6	27.6
4th " "	27.2	14.4	27.6	27.4
Average of last two weeks	28.2	15.	27.6	27.5

It will be noticed that while Nos. I. and II. had decreased about $3\frac{1}{2}$ lb. of milk per day at the end of the month from what they were on the average of the last two weeks of the previous month, Nos. III. and IV. had only decreased about 1 lb. of milk daily. Under normal conditions the usual decrease is about $\frac{1}{2}$ lb. of milk daily per week, or say from 2 to $2\frac{1}{2}$ lb. per month. In this case, therefore, Nos. I. and II. have decreased fully more than the normal, while Nos. III. and IV. fell off less than the normal; if, however, the average of the four is taken, the decrease is about the normal.

This shows that while the cows were fed on the vetches they

must have been producing up to their full capacity, when even with this succulent grass the normal decrease was reached.

The composition of the milk produced during this period was as follows:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on vetches . . .	3.72	4.28	3.29	3.20
1st week on sewage Italian . 2d " " .	3.8	4.2	4.	3.6
3d " " .	3.3	4.2	3.6	3.5
4th " " .	3.2	3.9	3.35	3.35
Average of last two weeks .	3.25	4.05	3.47	3.42

From the succulent nature of this grass, and the large quantity of it that was used, it would have been no surprise to any one to find that the quality of the milk had materially decreased; but, strange to say, while the milk of Nos. I. and II. has decreased in quality, that of Nos. III. and IV. has increased in quality.

What is also more strange still is, that the cows which have decreased most in quantity of milk on this food—viz., Nos. I. and II.—have also decreased most in point of quality, while the other two which fell off very little in their weight of milk have actually yielded milk of a better quality than previously.

When the Italian ryegrass was being used, it could not be said that any of the cows yielded milk of anything other than a normal quality, the average of the mixed sample for the last two weeks containing 3.48 per cent of butter-fat.

Brewers' Grains and Italian Ryegrass.

Brewers' grains, although comparatively speaking a rich food, have always had the name of producing an increased quantity at the expense of quality. As the sewage grass had of itself produced little or no effect on the quality of the milk, it was considered it would be a useful test to combine *brewers' grains* with the *Italian ryegrass,* as, judging from present knowledge, if any food was likely to lower the percentage of fat in the milk, this combination of foods was likely to do so. In order to ensure a supply of grains of the same quality during the continuance of the experiment, it was decided to use dried grains, as supplied by the Scottish Grains Co., Glasgow; because in an experiment of this kind any failure in the supply or difference in the quality introduces a disturbing element, which is seldom very easily discounted.

As brewers' grains had never previously been feed here alone to cows, it was not known exactly how many lb. could be used with safety. It was therefore considered that rather than any of the cows should break down owing to an excess of them, it would not be judicious to use more than 8 lb. daily to each animal. The grains were given mixed with a little water three times a-day.

It is also worthy of note that up to this time none of the cows had taken any water, although offered it occasionally.

The first grains were given on 14th August, and during the following month the yield of milk was as under:—

	No. I. lb.	No. II. lb.	No. III. lb.	No. IV. lb.
Average of the previous two weeks on Italian alone	28.2	15.	27.6	27.5
1st week on Italian and 8 lb. grains	28.	14.5	27.	27.2
2d week on do. do.	26.8	14.32	25.8	26.6
3d " "	26.6	14.28	26.6	25.6
4th " "	26.	11.2	25.2	26.
Average of the last two weeks	26.3	12.74	25.9	25.8

During this month the yield of milk from each of the cows decreased at a little less than the normal rate, showing that the food available for the production of milk was fully more favourable than what it even was the month previous. The extra quantity produced is, however, very trifling, and is very much less than popular opinion would lead one to believe it might have been.

Up to the end of the third week No. II. kept well up, after which it fell off very rapidly.

The butter-fat contained in the milk produced during this period was as follows:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on Italian alone	3.25	4.05	3.47	3.42
1st week on Italian, and 8 lb. of grains	3.	4.2	3.5	3.
2d week on do. do.	3.	3.	2.9	3.7
3d " "	2.75	2.8	2.6	2.7
4th " "	2.8	3.1	2.7	3.25
Average of the last two weeks	2.77	2.95	2.65	2.97

Two of the cows show a material decline in the quality of the milk during the very first week: one (No. III.) was a trifle improved, while No. II. went up to what it had been for several

weeks previous, showing that the slight depreciation in the quality of its milk during the last week they were fed with Italian grass was due to some other cause than the grass. By the third week all the cows were yielding milk of a very poor quality; and, strange to say, while there had previously been a difference of about 1 per cent of fat between the lowest and the highest quality with all the foods hitherto tried, with this one they were all within $\frac{2}{10}$ of 1 per cent of each other.

If this milk had been judged by the ordinary rules used by analytical chemists—viz., that pure milk should contain a minimum of 3 per cent of fat—then it would have been considered that cream to the extent of .25 per cent of butter-fat had been abstracted.

Unfortunately the specific gravity of this milk was not tested, as it would have been interesting to know what percentage of solids not fat it contained.

It is also worthy of notice that all the cows gave fully richer milk the fourth week than they did the third, when, as it were, the bottom was reached. So that, after all, a month is probably too short a time to judge of the full effect of any food on the milk of cows to which it is fed.

While the previous foods appeared to have little or no effect in increasing or decreasing the percentage of fat in the milk, there is little doubt but the combination of sewage-grown Italian grass and dried brewers' grains has had the effect of decreasing the amount of fat; for while the mixed sample of milk from all the cows fed on sewage grass, and yielded during the last two weeks of that period, gave milk with 3.45 per cent of fat, a similar sample during the last two weeks, when dried grains were used, gave milk with only 2.8 per cent of butter-fat. The difference here is .68 per cent of fat, which is something very considerable; or it may be better realised by the average dairyman if the milk from the Italian grass alone, and containing 3.45 of butter-fat, is valued for butter-making at 6d. per gallon, while that from the cows fed on sewage grass and dried grains, and containing only 2.8 per cent of butter-fat, would only be valued at about 4¾d. per gallon for the same purpose. Where only four cows have been tried it would be risky to say that this comparison is, under all circumstances, absolutely correct. Until further experience is obtained on the question, the statement must be taken for what it is considered worth.

Potatoes.

Up till 10th September the foods used had generally been of a very albuminous character, or having a close albuminoid ratio. An opportunity occurred just now of trying a food of an exactly

opposite kind—viz., *potatoes;* it was therefore decided to feed the cows on 8 lb. of Indian corn meal, 35 lb. of diseased potatoes daily, and a small quantity of Italian ryegrass—just sufficient to cause them to chew the cud and keep in good health, but not enough to in any way interfere with the other foods. The grass was given three times daily, and would average during the whole period from 20 to 25 lb. daily. The potatoes were given whole and raw, and the end of the first week was reached before the cows could be persuaded to take the full quantity either of them or the maize. The daily average weight of milk yielded by each cow during the month was as follows:—

	No. I.	No. II.	No. III.	No. IV.
	lb.	lb.	lb.	lb.
Average of the previous two weeks on dried grains and Italian .	26.3	12.74	25.9	25.8
1st week on 8 lb. maize and 35 lb. potatoes	27.8	11.2	25.2	26.2
2d week on do. do.	27.2	8.	25.2	24.6
		New cow.		
3d " "	27.2	28.	24.4	25.2
4th " "	24.8	28.4	21.	21.
Average of the last two weeks .	26.	28.2	22.7	23.1

Of the root crops none of them contain such a large amount of starch or its equivalent as the potato, while among grains the same holds good with regard to maize. In this country maize is not considered a good grain for milk-production; and while potatoes are held in high favour by some, others consider them very little better than good swedes. Although generally considered about the worst combination of foods that could be made, these foods, fed in the quantities stated and for the period referred to, produced nearly as much milk as the dried grains and a full quantity of sewage Italian.

In previous years, when diseased potatoes existed in greater abundance than could be readily used before they spoiled, I often thought the milk produced became smaller instead of greater, when potatoes were fed in large quantities. Such, however, does not seem to have been the case on this occasion. The three old cows kept up their quantity of milk extra well during the first three weeks of this experiment. Whether they were surfeited with an excessive quantity of food of one class, or from some other cause, they fell off very rapidly in their milk during the fourth week. This seems another indication that a month is too short a period to judge of the full effects of a food, or combination of foods.

The milk yielded during this period was of the following quality:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on 8 lb. dried grains and sewage Italian . .	2.77	2.95	2.65	2.97
1st week on 8 lb. maize and 35 lb. potatoes . . .	2.82	2.7	2.75	3.15
2d week on do. do. . . .	3.3	2.3	3.	2.7
		New cow.		
3d " " . .	3.35	4.7	3.25	3.1
4th " " . . .	3.45	4.	3.7	1.7
Average for the last two weeks	3.4	4.35	3.47	2.4

During this period several peculiarities are noticeable in regard to the quality of the milk.

Cow No. II. was going down so rapidly in her quality of milk, that it seemed as if she was likely to go dry very soon; she was therefore rejected at the end of the second week, and a new cow substituted. When this cow was put into the experimental lot, she had been calved three weeks, and was four years old. While the composite sample for No. II. yielded 2.3 per cent of fat for the second week, the milk produced during the last day or two of that week was much lower in quality than that, although giving at that time about 4 lb. of milk morning and evening. The last day of the second week her milk was tested separately, and only yielded 1.5 per cent of fat, and the following evening it had only 1 per cent of fat. After this she was milked only once a-day, and she went quite dry in about ten days.

It will be noticed that the new No. II. cow had very much richer milk the first week than any of the others, and that the next week there was a rapid decline. This is what usually happens with recently calved Ayrshire cows.

When the milk of cow No. IV. was tested at the end of the fourth week, the duplicate samples both recorded 1.7 per cent of fat. Up to nearly the end of the week this cow was yielding a gallon of milk morning and evening, and was not expected to be going dry; it was therefore considered some error had occurred in the sampling or testing. Two other samples were therefore drawn, but these also yielded 1.7 per cent of fat. It was therefore presumed that this cow was going dry, even although yielding such a large quantity of milk, and to prevent disturbing elements coming into the following month's results, she was set aside and another one substituted. The course followed was justified by the ultimate result, as this cow was almost dry in about another week.

Nos. I. and II. are therefore the only cows which can be relied on in regard to the effect of these foods on the quality.

The average quality of a mixed sample of these two cows' milk for the last fortnight of the previous test was 2.67 per cent of butter-fat, while for the last two weeks of this one it is 3.43 per cent of fat, showing a gain of .76 per cent of fat. This brings the average quality of these two cows to exactly what it was while they were being fed on sewage-grown Italian grass, seemingly proving that the use of large quantities of grains has a decided effect in lowering the quality of the milk.

Bean-meal.

For the production of milk or butter no concentrated food is in so general favour with dairymen as *bean-meal.* It was therefore decided to feed it to the trial cows from 8th October. A supply of fresh *carrot-leaves* being also at hand at this time, these were given to the cows in such quantities as they cared to eat, as the Italian grass was now becoming a little out of condition. Carrot-leaves are usually fed to the cows here for about one month every autumn, other green food being entirely dispensed with while they are in good condition. The cows are always very fond of them, and while they last keep up their milk-yield well. If, however, they are used in very large quantities, they are apt to have a rather laxative effect on the cows, making it difficult to keep them clean during that period. As in the previous test, the beans were given to the extent of 8 lb. daily, and as they were ground on the farm absolute purity was guaranteed. The weight of milk produced during this period was as follows:—

	No. I.	No. II.	No. III.	No. IV.
	lb.	lb.	lb.	lb.
Average of the previous two weeks on 8 lb. maize and 35 lb. potatoes	26.	28.2	22.7	23.1
				New cow.
1st week on 8 lb. beans and carrot-leaves *ad libitum* .	23.2	30.4	20.2	32.5
2d week on do. do. . . .	25.6	29.6	17.6	33.6
3d " "	23.	29.6	15.	33.4
4th " "	20.6	28.2	13.2	30.8
Average of the last two weeks .	21.8	28.9	14.1	32.1

During this period a new cow was substituted for the one which had previously been known as No. IV. The older calved cows, Nos. I. and III., fell off very much during this month in the quantity of their milk—the former on the average of the last fortnight of each period being down 4.8 lb. of milk daily, and the latter 8.6 lb. Both of these are a good deal above what is the average in normal feeding, showing that the food given

during the previous period was in excess of this one, or else the food used during this month was not so good as in the previous month for the production of milk.

Beans are usually considered very much better for this purpose than maize; the increase during the previous month may therefore be accounted for by the carrot-leaves consumed not being equal in feeding value to the potatoes used the month previous. Cow No. III. was falling off so quick in her yield of milk that it was thought advisable to put her aside at the end of this month, as, should she go dry during the next month, it would interfere with the reliability of the experiment. Cows II. and IV. fell off very little during the month, and seemed to be getting as much food as they could assimilate.

The following is the percentage of fat in the milk yielded by each cow during this month:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on 8 lb. maize and 35 lb. potatoes	3.4	4.35	3.47	...
1st week on 8 lb. beans and carrot-leaves *ad libitum* .	3.2	4.75	2.75	4.15
2d week on do. do. . . .	3.8	3.5	3.3	4.4
3d " " . . .	3.4	4.3	4.1	4.3
4th " " . . .	3.6	4.15	3.3	4.8
Average of the last two weeks .	3.5	4.22	3.7	4.5

Both of the older calved cows have yielded milk of a fully richer quality than they did the month previous, but it is so trifling that little reliability can be placed on it. On the other hand, one of the newly calved cows (No. IV.) has very materially improved in quality, while the other (No. II.), which is a little longer calved, has slightly decreased in quality. When the average quality of the milk of cows Nos. I., II. and III. is considered, it is found that there is very little difference between what it was during the period the cows were fed on maize and potatoes, and when they were fed on bean-meal and carrot-leaves. It is also worthy of notice that when fed alike the most recently calved cows give the milk richest in butter-fat.

Wheat.

A good deal has been written of late regarding the value of *wheat* for feeding purposes. It was therefore decided to use it during the month following the one when the bean-meal was fed. As these experiments had been principally carried out for the purpose of finding what effect the different foods would

have on the milk of the cows to which they were fed, all the changes which were made were between food of as opposite a character as possible, in the hope that the effects would be the more easily seen.

In selecting wheat, it was considered that this grain was fully as near the theoretical standard of Wolff as any mixed ration was likely to be. The grain supplied the greater portion of the feeding material of the ration, so that the other substances added would not very materially alter it, as they were only given in such quantities as would keep the animals in good health. The wheat was Square Head, grown during the year previous (1892); but as there was considerable damp and dull weather during the harvest of that year, the grain was a good deal darkened by smoke, and of course the selling value was much lessened. Previous to being fed to the animals it was passed through a pair of rollers, each grain being thoroughly bruised, yet little of it being ground into flour. When used it was mixed with chaff and warm water, each animal receiving 10 lb. daily. Wheat is generally considered an unsafe feeding material, but used in this way and in the quantities stated, the cows seemed in no danger of being surfeited; and had it not been for the risk of spoiling the experiment, it very likely would have been fed to them in larger quantities. Besides the wheat, each cow received daily about 15 lb. of cabbages and 12 lb. oat-straw. During this period the cows yielded the following quantities of milk:—

	No. I.	No. II.	No. III.	No. IV.
Average of the previous two weeks on 8 lb. beans and carrot-leaves *ad libitum*	lb. 21.8	lb. 28.9	lb. 14.1	lb. 32.1
1st week on 10 lb. wheat, &c. .	19.2	...	19.4	30.6
2d " " . .	19.2	25.4	27.2	29.2
3d " " . .	18.6	26.2	27.4	27.4
4th " " . .	17.2	25.2	28.6	24.4
Average of the last two weeks .	17.9	25.7	28.0	25.9

At the beginning of this test a newly calved cow was put in the place of cow No. III., and early in the first week cow No. II. had one of her teats burst by cow No. I. putting her foot on it. The injury seemed so serious that it did not appear that she would be of any further use for experimenting with; she was therefore rejected at the end of the week, and a new cow, which had calved two weeks previously, was put in her place. This was the first accident which occurred during the continuance of these experiments; and as the cow had only been under test for six weeks, and as the accident happened during

the first week of one of the feeding periods, it did not very materially interfere with the result.

During the month that the cows had wheat, No. I. (taking the average of the last two weeks of each period) fell off 3.9 lb. of milk daily, while during the previous period, when beans were fed, she fell off 4.2 lb. Owing to the substitution of new animals the same comparison cannot be made with the other cows. No. IV. cow fell off 6.2 lb. from the previous period, which, if she were a good animal, seems the double she should have done if the food supplied was of sufficient quantity and good enough quality. During this period each cow yielded milk of the following qualities:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on 8 lb. bean-meal, &c.	3.5	...	...	4.5
1st week on 10 lb. wheat, &c.	3.75	...	3.3	3.5
2d " "	3.75	3.6	4.2	3.55
3d " "	...	...	4.	...
4th " "	3.8	3.9	3.9	3.25
Average of the last two weeks	3.8	3.9	3.95	3.25

During the third week of this period, owing to an error in sampling, only the milk of cow No. III. was available for testing, the others being rejected as unreliable. It will be noticed that, with the exception of No. IV., the quality of the other three cows is fully better at the end of the month than it was at the beginning. In the case of No. I., it is impossible to say whether or not it is the food which is the cause of the improved quality, there being no corroborative evidence among the other cows. The milk of No. II. has improved, but having calved recently, it very likely would have done so naturally; while No. III. first improves and then becomes slowly lower in quality, which is the natural course to follow; and much the same may be said of No. IV. The alterations in quality may therefore be looked on as being more the effect of lactation than of food.

Decorticated Cotton-cake.

On the 3d of December the cows under test were fed with *decorticated cotton-cake*, ground into meal and mixed with wheat-chaff and warm water. It was intended to give them 8 lb. each daily, but the end of the first week was reached before cows Nos. I., II., and IV. consumed their full allowance, and it was the end of the third week before cow No. III. took all hers. In the interval a nearly equal weight of a mixture of bean-meal

and linseed-cake meal was given in order to give a full feed and yet work them on to the full quantity as quick as possible.

As most feeders know, decorticated cotton-cake is a rather dangerous food to use in large quantities, and more especially if the supply of roots is limited. In fact it seems too rich to be used extensively, unless combined with a very large quantity of roots, cut straw, or chaff. Many dairymen tell wonderful stories of the butter and cheese producing qualities of cotton-cake; and if some of those I have heard, more especially from the south of Cheshire, were related here, the urgent necessity would be shown for more extended experiments on the lines of those herein described. Any number of farmers and farmers' wives have informed me that they could have told from the curd-vat, or butter alone, the day on which decorticated cotton-cake was fed to their cows. Nevertheless such may have been the case, but with me there was no such noticeable features. Besides the 8 lb. of decorticated cotton-cake meal (made on the farm from sound fresh cake), each animal consumed daily about 15 lb. of cabbages and 12 lb. of oat-straw. During this month the cows yielded the following quantities of milk:—

	No. I.	No. II.	No. III.	No. IV.
	lb.	lb.	lb.	lb.
Average of the previous two weeks on 10 lb. wheat and same cabbages and oat-straw . . .	17.9	25.7	28.0	25.9
1st week on 8 lb. decorticated cotton-cake, &c. . . .	18.8	26.2	27.6	19.2
2d week on do. do. . . .	21.2	23.0	25.6	20.6
3d " " . . .	20.2	23.2	26.8	20.8
4th " " . . .	19.0	21.6	29.6	20.0
Average of the last two weeks .	19.6	22.4	28.2	20.4

During this period No. I. has during the last two weeks increased 1.9 lb. of milk daily from that which she was giving during the same period on the previous food, whereas if both foods had been equal in quantity and quality, she, under ordinary circumstances, should have fallen off to about that amount. This cow has therefore done well on the cotton-cake. With No. II. the case is, however, different, as she has fallen off one-half more than what the average cow does under ordinary conditions. The cow No. III. fell off materially during the first three weeks, because she was not then taking her full allowance of food, but as soon as she did so her milk increased considerably. No. IV. fell off the double she should have done under normal conditions, although consuming her full quantity of food almost the whole time.

During this period each cow yielded the following qualities of milk:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on 10 lb. wheat, &c. .	3.8	3.9	3.95	3.25
1st week on 8 lb. decorticated cotton-cake, &c. . .	3.95	5.1	4.15	4.25
2d week on do. do. . .	3.7	2.9	4.2	4.3
3d " " . .	3.4	3.2	3.8	2.4
4th " " . .	3.8	3.6	4.2	3.5
Average of the last two weeks	3.6	3.4	4.0	2.95

Comparing the last two weeks of this period with the last two of the previous period, when the cows were being fed on wheat, it will be seen that with one exception the quality of every cow's milk is slightly inferior instead of being very much superior, as some people would lead us to believe. It will be noticed that during the first week two of the cows gave milk of a very superior quality. In the case of No. II. this was very marked, more especially as she gave more milk that week than she had been yielding on the average of the previous two. This, however, did not continue, for the following week the quality of her milk was as far down as it had been up the one previous.

The next week No. IV. yielded milk of an abnormally low quality, and I began to fear that there might be some inaccuracy in the sampling; so the last week I did all the sampling myself, the result being that the qualities turned out for that week very much what they had been the previous month. So it is impossible to say whether the abnormally high and low qualities yielded during this period were the result of careless sampling, the quality of the concentrated food used, or the injudicious feeding; for no doubt using such a quantity of cotton-cake in the way it was done here was injudicious feeding, and if continued for any great length of time would assuredly have proved itself so.

During this period the specific gravity of the mixed sample of milk for each week was also taken, and the average for the last two weeks was as follows:—

No. I.	No. II.	No. III.	No. IV.
1032.	1032.	1032.5	1030.5

According to the Quevenne scale this would give the following solids not fat in the milk of these cows:—

	No. I.	No. II.	No. III.	No. IV.
Average of last two weeks of solids not fat . . .	9.09	9.04	9.30	8.55

Barley-meal.

On the last day of the year *barley-meal* was substituted for cotton-cake. These two foods are of an exactly opposite character, the one being both very albuminous and oily, while the other is the most starchy food of any of the grains grown in this country. If, therefore, either was likely to have any material effect on the milk produced from their consumption, one would expect to find it in such a case as this. During this period not only was the percentage of butter-fat and the specific gravity found for each cow during the whole period, but the live-weight of the animals was taken both at the beginning and end of the period. The live-weight of the animals was intended to have been taken from the very beginning of the grain-feeding tests, but the weighbridge having gone wrong, it took longer than was anticipated to get it put into thorough working order and to have it properly tested.

When cotton-cake was being fed to the cows, it took a considerable time to get them so accustomed to it as to consume the whole of their food.

With the barley there was, however, no difficulty in that way at all, as from the very first day each animal consumed its full quantity of 10 lb. daily.

Besides the barley-meal, each animal consumed daily on an average about 15 lb. of cabbages and 12 lb. of oat-straw.

Where animals are being heavily fed, this in itself is a consideration which should not be left out of account, as palatableness is an important factor, not only in the food of man, but also in that of animals.

The live-weights given are the average of two weighings, taken on the Saturday and Monday at the same hour, at the end of one period and beginning of the next.

LIVE-WEIGHTS.

	No. I. lb.	No. II. lb.	No. III. lb.	No. IV. lb.
Beginning	940	1046	944	972
End	1008	1106	960	1002
Difference	+68	+60	+16	+30

From the above table it will be seen that the cows made very substantial live-weight gains during this period, besides the milk they were producing. Of course the cows which made the greatest gains in live-weight were only giving a comparatively small quantity of milk; but it will be noted that although No. IV. was giving the smallest quantity of milk, she only made half the live-weight gain of Nos. I. or II., and yet she was as young an animal and of a class likely to grow as any of the

others. No. III. was giving a good quantity of milk, and it would have been no surprise if she had even made a less gain than she did.

The following quantities of milk were yielded by each cow during this period:—

	No. I.	No. II.	No. III.	No. IV.
Average of the previous two weeks on 8 lb. decorticated cotton-cake, cabbages, and oat-straw . .	lb. 19.6	lb. 22.4	lb. 28.2	lb. 20.4
1st week on 10 lb. barley-meal, &c.	20.1	20.3	32.3	20.6
2d " "	18.4	19.4	29.4	18.8
3d " "	18.4	18.8	27.9	17.6
4th " "	18.3	18.6	27.7	12.8
Average of the last two weeks .	18.3	18.7	27.8	15.2

It will be seen that cows Nos. I., II., and III. have maintained their quantity of milk fairly well when fed on barley compared with decorticated cotton-cake. The decrease of Nos. I. and III. is probably less than it would have been under normal feeding, that of No. II. is about the usual, but No. IV. has decreased more than the average of cows do. With dairymen barley is not in very good repute as a food for milk-cows, but judging from this short test it is not so far behind cotton-cake as many suppose. It must also be taken into consideration that these cows were receiving a very limited quantity of succulent food, and nothing in the nature of draff or brewers' grains, to assist in keeping up the flow of milk, the barley forming the bulk of the food consumed.

During this period the milk contained the following percentages of butter-fat:—

	No. I. Per cent of fat.	No. II. Per cent of fat.	No. III. Per cent of fat.	No. IV. Per cent of fat.
Average of the previous two weeks on 8 lb. cotton-cake, &c.	3.6	3.4	4.	2.95
1st week on 10 lb. barley, &c. .	3.55	3.35	4.3	3.25
2d " " .	3.6	3.25	4.1	2.9
3d " " .	3.55	3.4	4.1	2.8
4th " " .	3.5	3.3	4.55	2.9
Average of the last two weeks .	3.52	3.35	4.32	2.85

Comparing the results obtained above with those of the previous period, it will be seen that while three of the cows have yielded milk containing a trifle less fat than what they did when being fed on cotton-cake, one of them has gone considerably the other way, and that not only for one week, but for every week of the whole month.

The specific gravity of the milk yielded during the last two weeks of both periods was as follows:—

	No. I.	No. II.	No. III.	No. IV.
Cows fed on decorticated cotton-cake	1032.	1032.	1032.5	1030.5
Cows fed on barley	1030.5	1031.	1032.	1026.

According to the scale previously used, this would give the following solids other than fats:—

	No. I.	No. II.	No. III.	No. IV.
Average of last two weeks when fed on cotton-cake . . .	9.09	9.04	9.30	8.55
Average of last two weeks when fed on barley	8.67	8.77	9.24	7.36

In every case the solids other than fats are less when the cows were fed on barley-meal than when fed on cotton-cake. The latter being a very albuminous food, the result is what popular opinion has always considered it should be.

Had I had the means at my disposal, I should have liked to have estimated the sugar and casein in these two samples of milk, but not having suitable apparatus, I was unable to do so. But although a large quantity of albuminoids seems in the case of decorticated cotton-cake to increase the solids not fats in the milk, an equally large quantity of oil in the shape of cotton-seed oil does not seemed to have increased to any appreciable extent the fat in the milk.

Linseed-cake.

On 27th January 1894 the cows under experiment were fed with a good brand of American Western linseed-cake. During the whole month following each cow had as much cake as she cared to eat, but it was not until the last week that any of the animals consumed 8 lb. daily. No. III. was one of the best feeders in the lot, but towards the end of the third week she fell off fully one-third in her milk all at once, and although she continued to eat moderately well, still she seemed more or less surfeited. As three of the experimental cows were now giving a very small quantity of milk, other three new cows were put in at the beginning of this month which had calved about four weeks previously.

Besides the linseed-cake, each cow received daily about 15 lb. of carrots and 12 lb. of oat-straw.

The following are the live-weights at the beginning and end of this month:—

	No. I.	No. II.	No. III.	No. IV.	No. VI.	No. VII.	No. VIII.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Beginning . .	1008	1106	960	1002	996	924	817
End . . .	980	1129	955	1008	972	887	852
Difference . .	−28	+23	−5	+6	−24	−37	+35

The live-weights clearly show that the animals never appreciated such a large quantity of linseed-cake, and given as it was used here. At first it was all given as nutted cake, but when it was found that the cows would not take anything like their quantity, a portion of it was given as meal, mixed with chaff, over which boiling water was poured. By this means the quantity which each animal would eat was slightly increased; but it was only during the last week, and even then with difficulty, that they could be persuaded to take the full allowance of 8 lb. During the whole month few of the animals cleaned up their cake when it was given to them, and, as a rule, some of them left a portion of their feed unconsumed. In this respect there was a marked contrast to the manner in which the troughs were cleaned out the month previously, when the cows were being fed on barley-meal.

It is therefore no wonder that the old set of cows have remained almost stationary, two being down on the total 33 lb. and two up 29 lb. Of the three recently calved cows, one has lost nearly 1 lb. per day, another fully 1 lb., while the smallest cow and the heaviest milker has actually gained more than 1 lb. daily.

For her size, cow No. VIII. has milked exceptionally well; and it will be interesting to note how she continues to milk later on in the season, as being only recently purchased her previous qualifications are quite unknown.

The following quantities of milk were yielded by each cow during this month:—

	No. I. lb.	No. II. lb.	No. III. lb.	No. IV. lb.	No. VI. lb.	No. VII. lb.	No. VIII. lb.
Average of the previous two weeks on 10 lb. barley-meal, turnips, and oat-straw .	18.3	18.7	27.8	15.2	..	..	..
1st week on 8 lb. linseed-cake	17.8	18.	26.2	15.	33.2	31.8	32.6
2d " " .	18.1	19.6	26.6	12.8	32.4	32.6	32.7
3d " " .	18.4	19.	31.4	10.6	34.4	34.2	38.6
4th " " .	20.	18.2	21.4	11.6	35.8	37.6	39.
Average of the last two weeks	19.2	18.6	26.4	11.1	35.1	35.9	38.8

With the exception of No. IV., all the old cows are giving much about the same quantity of milk as they were doing at the end of last month. No. III. fell off very much during the last week, owing, apparently, to an overdose of cake; but as she had yielded very well during the previous week, the average for the two weeks is just about the usual. It will be noticed that cow No. I. has increased slightly in milk, while she fell off considerably in live-weight. The newly added cows have all considerably increased in their yield of milk.

During this month the milk of the different cows contained the following percentages of butter-fat:—

	No. I. Per c. of fat.	No. II. Per c. of fat.	No. III. Per c. of fat.	No. IV. Per c. of fat.	No. VI. Per c. of fat.	No. VII. Per c. of fat.	No. VIII. Per c. of fat.
Average of the two previous weeks on 10 lb. barley-meal, &c.	3.52	3.35	4.32	2.85	..	..	..
1st week on 8 lb. linseed-cake, &c.	3.7	3.6	4.1	3.	3.5	4.4	4.1
2d " "	3.8	3.6	4.1	3.4	3.6	4.1	3.
3d " "	3.75	3.35	3.7	3.35	2.85	3.7	3.6
4th " "	3.5	3.25	3.6	3.45	3.75	3.75	3.6
Average of the last two weeks .	3.62	3.30	3.65	3.40	3.3	3.72	3.6

A study of the above figures clearly shows, as far as the milk of these cows goes, that even the large quantity of linseed-cake given has had no appreciable effect in increasing the percentage of butter-fat.

The primary objects of these experiments was to find what effect, if any, the different foods, used in fairly large quantities, would produce on the percentage of butter-fat in the milk. In one case the percentage seems to have been reduced, but in no case do any of the foods used appear to have had much effect in raising the percentage above the normal.

The specific gravity of the milk yielded during the last two weeks of each of the previous two months was as follows:—

	No. I.	No. II.	No. III.	No. IV.	No. VI.	No. VII.	No. VIII.
Fed on barley-meal	1030.5	1031.	1032.	1026.	..	..	..
Fed on linseed-cake	1030.	1029.	1030.7	1026.5	1029.5	1031.5	1030.5

According to the scale previously used, this would give the following percentages of solids other than fats:—

Average of last two weeks—	No. I. per c.	No. II. per c.	No. III. per c.	No. IV. per c.	No. VI. per c.	No. VII. per c.	No. VIII. per c.
Fed on barley-meal .	8.67	8.77	9.24	7.36	..	..	..
Fed on linseed-cake .	8.56	8.24	8.75	7.6	8.37	8.98	8.69

While the solids other than fats seemed to be materially altered by the change from decorticated cotton-cake to barley-meal, yet they do not appear to have been much affected by the change from barley-meal to linseed-cake.

On the last day of the second week of this period, cow No. IV. appeared to be in season, and at two milkings had only about 2½ lb. of milk each. This milk looked very thin, and did not seem to have much cream in it at all. It, however, was tested separately, and was found to have a specific gravity of 1023.0, with 5.1 per cent of fat, and would contain 7.04 of solids other than fats. This was quite the reverse of what was expected, as it turned out to be the solids other than fats that were awanting, the latter being present in unusual quantity.

Mixed Ration.

From 25th February the cows were fed on a ration of mixed grain and cakes with Timothy hay and oat-straw, so arranged

as to give an albuminoid ration of about 1 to 5.9, which is generally looked on as being very near the theoretical standard of Wolff. During this period the daily food used was as under:—

	lb.	lb.
Timothy hay	6	
Oat-straw	4	
Carrots	20	
		30
Beans	2	
Barley	1½	
Cotton-seed	½	
Linseed-cake	1	
Maize	2	
Bran	1	
Dried draff	2	
		10
Total		40

The concentrated food after being weighed was mixed together before grinding. It was fed three times daily, mixed among a small quantity of wheat-chaff and warm water. The cows were all through very fond of this mixture, and on no occasion left any of it, nor did they seem fed to their utmost limit, as was the case with some of the other foods.

The following are the live-weights of the cows at the beginning and end of this period of feeding:—

	No. I.	No. II.	No. III.	No. IV.	No. VI.	No. VII.	No. VIII.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Beginning	980	1129	955	1008	972	887	852
End	977	1162	968	1047	962	858	797
Difference	−3	+33	+13	+39	−10	−29	−55

As on the previous occasions, the live-weights are the average of two weighings, made on different days at the end of the period, each weighing being carried out on every occasion at the same hour. It will be noticed that cows Nos. I., II., and III., although giving very little milk, have not on the average made very great progress, No. I. having actually gone a little back; so that these cows might have done as well, or at least might have given a better profit, with less food, as they do not seem to have been assimilating it all. No. IV. milked moderately, and made good progress in weight; but No. VI. is disappointing, as, although she milked moderately as regards quantity, it will be seen further on that it was excessively poor. It is generally believed that if a cow gives poor milk or little of it, she puts on her back what she does not give off in milk; but this cow, although to all appearance healthy, does not seem to have made

such a gain as one would have expected either. Cows Nos. VII. and VIII., it will be noticed, have lost ¼ cwt. and ½ cwt. respectively in weight in a month, which is very heavy. Both cows milked very well, showing that where there is a strong tendency to produce milk it is difficult to give the animal sufficient food to enable it to give its maximum quantity of milk and yet keep up the weight of its body.

The following quantities of milk were yielded by each cow daily during this period:—

	No. I. lb.	No. II. lb.	No. III. lb.	No. IV. lb.	No. VI. lb.	No. VII. lb.	No. VIII. lb.
Average of the previous two weeks on 8 lb. linseed-cake, turnip, and oat-straw . .	19.2	18.6	26.4	11.1	35.1	35.9	38.8
1st week 10 lb. mixed grain .	17.4	18.0	24.6	10.6	33.2	35.8	38.4
2d " " .	16.8	17.2	24.0	10.3	31.0	38.8	38.6
3d " " .	16.4	15.8	23.7	9.7	29.8	39.7	38.7
4th " " .	14.6	12.8	23.7	9.2	28.4	39.3	38.7
Average of the last two weeks .	15.5	14.3	23.7	9.4	29.1	39.5	38.7

Cows Nos. I., II., and IV. are falling off in their milk very quickly, notwithstanding the large quantity of food they are receiving. Cow No. IV. calved about 20th September, and in six months she is yielding less than 1 gallon of milk daily. No. III. calved a week after No. IV., yet at this date she is giving more than double the quantity of milk of No. IV. Cow No. I. has at this date been in milk nearly double the length of time of No. II. or No. IV., and yet she is giving more milk than either, and that of very much better quality also. According to their size, Nos. VII. and VIII. are milking very well, the latter particularly, as she is the smallest cow in my possession.

The addition of 2 lb. of *dried grains* to the food does not seem to have had any marked effect in raising the quantity, lowering the quality, or in preventing its natural decline.

The quality of the milk yielded by each cow during this period was as under:—

	No. I. Per c. of fat.	No. II. Per c. of fat.	No. III. Per c. of fat.	No. IV. Per c. of fat.	No. VI. Per c. of fat.	No. VII. Per c. of fat.	No. VIII. Per c. of fat.
Average of the previous two weeks on 8 lb. of linseed-cake, &c.	3.62	3.30	3.65	3.40	3.3	3.72	3.6
1st week on mixed grain, &c.	3.6	3.3	3.8	3.15	3.2	3.4	3.9
2d " "	3.6	3.1	3.65	2.75	2.4	3.9	3.5
3d " "	3.95	3.05	3.8	3.15	3.	3.6	3.
4th " "	4.	2.85	4.2	3.2	2.5	3.7	3.
Average of the last two weeks	3.97	2.95	4.	3.17	2.75	3.65	3.

The points requiring to be particularly noticed here are the excessively low per cent of fat in the milk of cows Nos. II., IV., and VI. For the half of the month cow No. VI. yielded

milk which probably every analyst in the country would have condemned as having had a portion of its fat abstracted, while for one week during the month cows Nos. II. and IV. were also in the same position. This has happened where the food given was in abundance, of a mixed variety, and with each of the ingredients in the proportion supposed to give the best results. This low quality of milk is also not the result of one day's abnormal milk production, but the average quality produced for one and two weeks. If, therefore, milk of this low quality is produced under these circumstances, it is difficult to estimate what it will be under circumstances which are familiar to many milk-producers.

It is difficult to say exactly whether or not the grains used have had any influence in bringing about this result, but it at least is suspicious, because much the same happened on a previous occasion when the concentrated food was composed entirely of dried grains.

It must, however, be noticed that cows Nos. I. and III. have increased in quality fully as much as the other two have fallen off, so that the low quality of the milk of cows Nos. II., IV., and VI. is more likely to have been the effect of some constitutional cause than that of the food used.

The specific gravity of the milk yielded by the different cows during the past and previous month was as follows for the last two weeks of each period:—

	No. I.	No. II.	No. III.	No. IV.	No. VI.	No. VII.	No. VIII.
Fed on linseed-cake .	1030.	1029.	1030.7	1026.5	1029.5	1031.5	1030.5
Fed on mixed grain and cake . . .	1031.	1026.	1031.5	1023.	1030.	1034.	1031.5

According to the scale previously used, this would give the following percentages of solids, not fats:—

Average of last two weeks—

	No. I.	No. II.	No. III.	No. IV.	No. VI.	No. VII.	No. VIII.
Fed on linseed-cake .	8.56	8.24	8.75	7.6	8.37	8.98	8.69
Fed on mixed grain and cake . .	8.91	7.38	9.04	6.63	8.38	9.62	8.83

The most noticeable feature here is the low percentage of solids other than fats in the milk of cows Nos. II. and IV., which are again much below what is usually looked on as the standard for average milk.

The following table gives a summary of the results of the feeding during the previous ten months by the various foods used, the results given being the averages of the third and fourth weeks after the food was first supplied:—

Food used.	Last date food fed.	No I.		No. II.		No. III.		No. IV.		No. VI.		No. VII.		No. VIII.	
		Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
		lb.	p. c.	lb.	p. c.	lb.	p. c.	lb.	p. c.	lb.	p. c.	lb.	p. c.	lb.	p. c.
Fresh pasture (old)	June 19	34.0	4.0	22.6	4.8	34.2	3.2	28.8	3.7						
Fresh vetches	July 16	30.8	3.7	18.0	4.3	28.2	3.3	28.5	3.1						
Sewage-grown Italian	Aug. 13	28.2	3.2	15.0	4.0	27.6	3.5	27.5	3.4						
Dried grains 8 lb., and Italian	Sept. 10	26.3	2.8	12.7	2.9	25.8	2.6	25.8	2.9						
" " "	"	...	...	9.6	2.5	...	...	...	3.1						
Maize 8 lb., potatoes 35 lb.	Oct. 8	26.0	3.4	28.2*	4.7	22.6	3.5	23.0	1.7						
Bean-meal 8 lb., and carrot-leaves	Nov. 5	21.8	3.5	28.9	4.1	14.1	3.0	32.1†	4.2						
Wheat (bruised) 10 lb., cabbages, and oat-straw	Dec. 2	17.9	3.8	25.7	3.9	28.0‡	3.9	25.9	3.2						
Decorticated cotton-cake 8 lb., do., do.	Dec. 30	19.6	3.6	22.4	3.4	28.2	4.0	20.4	2.95						
Barley-meal 10 lb., do., do.	Jan. 27	18.3	3.52	18.7	3.35	27.8	4.32	15.2	2.85						
Linseed-cake 8 lb., do., do.,	Feb. 24	19.2	3.62	18.6	3.30	26.4	3.65	11.1	3.40	35.1	3.3	35.9	3.72	38.8	3.6
Grain and cake mixed 10 lb.	March 24	15.5	3.97	14.3	2.95	23.7	4.0	9.4	3.17	29.1	2.75	39.5	3.65	38.7	3.0

No. I. calved middle of May 1893.
No. II. calved about middle of February 1893.
No. III. " " March 1893.
No. IV. " " February 1893.

No. VI. calved about January 5.
No. VII. " January 15.
No. VIII. " January 20.

* Calved September 3, 1893. † Calved September 20, 1893. ‡ Calved September 27, 1893.

These experiments, as already stated, were begun for the purpose of noting what effect, if any, these foods and fodders would have on the butter-fat of the milk of cows fed largely with them. The increase or decrease of the live-weight of the animals, or the solids other than fats, were only taken note of latterly when it was seen to be an advantage to do so.

Conclusions.

The principal conclusions to be drawn from these tests are as follow:—

1. That really good milking cows will lose in weight of body for some weeks after calving, no matter what is the quantity or quality of their food.
2. That when a cow in good condition is in full milk, she will give her normal quality of milk at least for a limited time, even although the quantity or quality of her food be deficient.
3. That when in good condition, a heavy milking cow will take flesh or fat off her body in order to give her normal quality of milk.
4. That although the quantity of milk is easily influenced up to a certain point by the food supplied, the quality is not materially altered by any ordinary mixed food.
5. That the proportion of butter-fat is very little influenced by foods containing a large percentage of oil, such as linseed or cotton cake, nor yet by albuminous foods such as bean or pea meal, decorticated cotton-cake, &c.
6. That highly albuminous foods have a slight influence on the solids not fats.
7. That any increase in the quantity or quality of milk over the present normal standard is to be looked for more from breeding than from feeding.
8. That if the food ingredients are present in sufficient quantity in a state palatable to the animal and easily assimilated, it does not seem to make much difference from what source they come.
9. The aim of all producers of milk should therefore be to use foods which will produce quantity more than quality, provided that they contain no taint or flavour which can be conveyed to the milk.
10. Leaving nutritive ingredients out of account, none of the foods used seem to have had any very special effect in increasing the quantity.

SHELTER FOR SHEEP.

By Professor John Scott.

It is surely one of the greatest negligences of British husbandry that our flocks are not more carefully protected in winter. The sheep is now the only domestic animal which, at the most inclement season of the year, is left on the hills and in the fields, exposed to all the vicissitudes of our cold and damp climate. To what a pitiful condition has many a fine flock been reduced by this neglect; and how great the mortality amongst them at times, especially amongst hill sheep, when they have been exposed to the double severities of a hard winter and a late spring!

Shelter for Cattle.—Before the invention of hay, our forefathers allowed their cattle to wander about the fields and woods all winter, half-starved as well as shelterless; and under this system of exposure and imperfect feeding the cattle, in course of time, grew so stunted and small as to be appropriately called "runts." With the introduction of hay-feeding, the cattle were housed in winter, and then began that marvellous improvement of the breeds which has gone on ever since, and of which we are witnesses to-day. Not less than £5 per head is now invested in house-shelter for cattle, which represents a capital outlay of £6,250,000 for sheltering the 1¼ million of cattle in Scotland.

Want of Shelter for Sheep.—But while cattle are now well cared for, practically nothing has been done to provide shelter for sheep. Yet the 7½ millions of sheep in Scotland pay fully one-third of the agricultural rental of the country, which is probably more than cattle do, and in intrinsic value the sheep stock is worth as much as the cattle stock. It might also be affirmed that mutton is not only raised at less cost, but sells at a relatively higher price per pound than beef; and sheep yield wool in addition to mutton.

These ought to be strong inducements to give sheep some of that shelter which is so readily afforded to cattle. Personal interest and the laws of humanity alike call for every effort to promote the comfort and value of an animal which both feeds and clothes mankind, and from which so much of the rental of the country is derived. But the hardest treatment seems to be considered good enough for sheep. Notwithstanding that our flocks are now of a far better and more valuable kind, they are condemned to weather every storm of winter just as the sheep of a very inferior kind had to do in the primitive condition of agriculture, before the invention of hay or the introduction of turnips and other winter foods.

Death-rate amongst Sheep.—Every flockmaster's mind must be impressed with bitter recollections of the severity of his losses in bad seasons. The annual mortality amongst sheep of all kinds in Scotland is never less than 5 per cent, and in bad winters it is as much as 10 and even 15 per cent, with an average death-rate of 7 or 8 per cent. Of course, losses can never be wholly prevented; but sheep are not allowed to live long enough to die of old age, and, in the absence of epidemic and contagious diseases, any loss above 1 or 2 per cent amongst them is preventable, being due either to exposure or starvation, or more frequently to both of these causes combined.

Losses from Exposure.—From habitual residence on the land, and exposure to all kinds of weather and changes of temperature, sheep are very liable to colds and chills; and as little notice is taken of ordinary catarrh amongst sheep—and some present-day breeds are not characterised by hardiness of constitution—it is no wonder that, when the weather is severe, ordinary catarrh often assumes a malignant form. The lung disease from which sheep have suffered severely, in some parts of the country, in recent years, has its origin in an ordinary cold and exposure, and is neither contagious nor hereditary, though it prevails as an enzootic during severe seasons, where the sheep are in a debilitated condition and shelter is neglected. One who has opportunities of seeing large numbers of old ewes slaughtered for the London market, says he has been surprised to find so many of their lungs very much diseased; some of them having abscesses formed, while in others the lungs have grown tight to the ribs. Even during the bad rotting seasons of 1879-82, ewes that were supposed to be tainted with liver-rot, when killed were found to be more diseased about their lungs than their livers. This shows that ewes and young sheep intended for breeding purposes ought to have much better shelter than is generally provided for them. They cannot stand the severities of five or six winters, and breed and suckle strong healthy lambs, unless they are sheltered with care.

No amount of feeding will make sheep fatten well, nor keep them healthy, when their wool is soaking wet for days and even weeks on end, and when they have to sleep at night on cold damp ground. And exposure to the cold and extended rains of winter is almost as bad for the wool as for the animal itself; for wool frozen when wet becomes harsh and brittle, and its market value suffers in proportion as its wearing quality is injured.

Shelter for Hill Sheep.

Hill sheep call to be considered first in the matter of shelter, if for no better reason than that two-thirds of all the sheep in

Scotland are hill sheep. They are also more exposed to all the severities of our changeable and excessively wet climate than sheep on enclosed land. Winter exposure would be hardship enough if the sheep were well fed on dry and nourishing food, but it is ten times worse when, as is usually the case, they get little or nothing in addition to the scanty and worthless herbage which at that season can be picked up on the hills. If the winter is mild and favourable, the losses may be comparatively light, and the sheep in fair condition at Whitsunday; but when the winter is a bad one the losses are enormous, and the survivors mere bags of bones, with almost as little wool as flesh on them.

Preventable Losses.—The prodigious mortality from starvation and exposure, and from such fatalities as being buried under snow, and driven into burns and drowned, which periodically marks the history of sheep-farming on our hills, is everything but creditable to this branch of British agriculture; for the losses under each of these heads are largely if not wholly preventable.

In the memorable winter of 1859-60 nearly one-fourth of the hill sheep of Scotland perished, and with more providential care this fearful loss could not have occurred. The snowstorms of 1882-83 and 1885-86 were also very disastrous. Heavy expenses in foddering hill flocks while the storms lasted did not prevent great mortality amongst them, while the produce of lambs and wool for these years did not amount to much more than half an average yield. And although, fortunately, every year is not so bad as those specially referred to, there is scarcely a winter, however mild, that is not severe enough to cause excessive mortality amongst hill sheep.

The hardy nature of the Blackfaces is proverbial, but there is a limit even to their endurance; and when snowstorms occur in March or April, as often happens, and ewes heavy in lamb have to rustle for it, and sometimes are blocked in by snow for days or even weeks, the wonder is that more of them do not die of exposure and starvation, that the condition of the survivors is not worse, and that the number of ewes without lambs the following summer is not greater. When the hill shepherd goes his morning rounds in a severe spring-time, he may well congratulate himself when he does not find a lamb, hanging with icicles perhaps, standing by its dead mother; or when he does not meet with the more frequent occurrence of a dead lamb, which was deserted by the poor mother, which had no milk to give her offspring.

Stells and Keb-houses.—Most hill farms are provided with a certain number of open shelters in the form of stone "beilds" or "stells," but the fact that so many of these have been allowed

to fall into decay and disuse goes to show that they do not fully serve the purpose intended.[1]

The Teviotdale Farmers' Club discussed the question of "Stells and Keb-houses" a few years ago, and while most of the speakers had a word to say in favour of open stells, it was clearly to be seen that they put comparatively little value on the open stell that has no keb-house attached to it. The opinion of the Club was that stells should be circular in form, and each large enough to hold a whole cut of 200 sheep within its walls. The cost of such a stell—a circular dry-stone dyke, enclosing a space about 15 yards diameter, and with a keb-house 15 feet by 12 feet attached—was stated to be £15, exclusive of fittings and cartage of materials. Three stells of this size are required for a hirsel of thirty score, and the outlay of £45 is exactly 1s. 6d. per sheep. The annual charge on this sum amounts to very little more than 1d. per sheep. Every flockmaster will agree that these stells and keb-houses are worth much more than that to him; at the same time there can be little doubt that both stells and keb-houses have served their day and generation, and that better means of shelter will have to be provided for hill-flocks in the immediate future, if there is to be any future at all for store-farming in this country.

Sheep often suffer more by exposure in wet sleety weather than in a slight snowstorm, and at such times the open stell is no protection at all. In a snowdrift again, even when the sheep are inside the stell, they are never comfortable, for the drift goes through the dry-stone walls. If the sheep are outside the walls, the stell is a dangerous shelter in drifts, especially to ewes getting heavy in spring. And what is almost as bad, when sheep have to be hay-fed at the open stell, as fed they must be if they are kept there when they would otherwise be foraging for themselves, the hay either gets blown away by the high wind which accompanies a snowdrift, or gets soaked in wet sleety weather, and then the sheep will not eat it. In either case much of the hay is wasted, and the sheep are as much starved as if they were not hand-fed at all.

The *keb-house* is useful at lambing-time; but it is far too small for its purpose, and its construction is the very opposite of what a sheep-house ought to be. It can barely accommodate a dozen ewes and lambs at a time. The consequence is, scores of young lambs on every hirsel are left to perish for want of the shelter which the keb-house is supposed to provide for them. And even with its small complement of only a dozen sheep inside the keb-house for a single night, they are so much in

[1] All the different kinds of stells—inside, outside, with and without plantations, &c.—are fully illustrated and described in vol. i. of the 'Book of the Farm,' fourth edition, by James Macdonald.

danger of suffocation that they would often be safer outside in the storm. These are fatal defects, which doom the keb-house, like the open stell, to give place to something better.

> "First I ordain the fodder'd sheep to feed
> In shelt'ring cotes till summer shades the mead."
>
> —VIRGIL.

Sheds for Storm Shelters.—An open shed, with a good roof and a dry floor, is all the shelter that sheep require; and sheds roomy enough to give covered shelter to the entire flock can be erected at about as little expense as the open stells and keb-houses, or, certainly, at a cost not exceeding 2s. per sheep. Sheds at that price, it is true, can only have walls built of turf, and roofs covered with thatch of heather or rushes; yet structures of the kind can be made very snug, serve well for storm-shelters, or even for laying the flock into every night during the winter, and will last for many years. A circular shed, having an outer wall of turf 7 feet high, and a lean-to roof 10 feet wide, with the lower ends of the rafters resting on an inner circle of posts—the space between the posts open, or only fenced by light hurdles—makes a sheep-house that is at once comfortable and well ventilated. In building sheds of this class, a good deal of the work might be done by the shepherds themselves, when the cost would be lessened. On many estates, too, thinnings of larch poles, suitable for rough posts and rafters, could be supplied at a cost which would still further reduce the estimated expense.

For occasional shelter a shed area of 9 superficial feet per sheep is ample, when one side of the shed is open. This area is afforded for 200 sheep, with an outer wall diameter of 70 feet; for 600 sheep, with a diameter of 190 feet; and for 1200 sheep, with a diameter of 369 feet—assuming the width of shed in each case to be 10 feet. The dimensions, areas, quantities of materials required, and approximate cost of three such sheds, are given in Table I.

The two larger sheds need interior divisions to separate the sheep into lots of not more than 200 in each division; but a few movable hurdles will serve for that purpose; and in the lambing season any number of small pens, for single ewes and their lambs, can be readily formed as needed by the use of more hurdles. Racks should be fitted up along the shed walls, so that the sheep can feed under cover, where the hay will neither get wet nor wasted; and water-troughs should always be accessible to the sheep. The floors of the sheds will be kept thoroughly dry by littering with peat-moss, or bottoming with burnt clay. There is ample room for hay-stacks or silos in the yards of the larger sheds, and where the yard is a small one the stacks will be con-

venient if built outside near the entrance gate. The site chosen for the sheds should be dry ground, sheltered from the north, with access to the hill and also to the hay-parks if there are any.

With the sheep in such quarters, and a sufficient stock of hay

TABLE I.

		Shed for 200 sheep.	Shed for 600 sheep.	Shed for 1200 sheep.
Diameter	ft.	70	190	369
Circumference	"	220	596	1159
Gateway	"	12	24	24
Outer wall	lin. ft.	208	572	1135
Width of shed	ft.	10	10	10
Inner circle (posts)	"	145	510	1072
Shed area	sq. yds.	196$\frac{1}{9}$	601	1226$\frac{1}{9}$
Shed area, per sheep	sq. ft.	8.8	9.2	9.2
Turf wall	lin. yds.	69$\frac{1}{3}$	190$\frac{2}{3}$	378$\frac{1}{3}$
Posts	No.	25	73	134
Rafters	"	29	96	214
Eave and wall plates	lin. ft.	343	1082	2207
Laths	lin. yds.	600	1800	4000
Thatching	sq. yds.	196$\frac{1}{9}$	601	1226$\frac{1}{9}$
Gates (outer)	No.	1	2	2

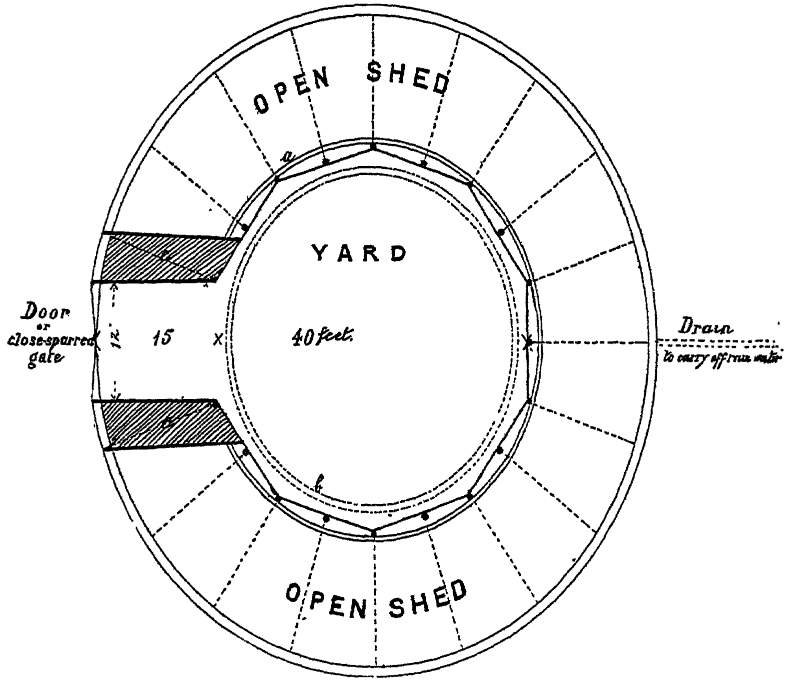
APPROXIMATE COST.

		£	s.	d.	£	s.	d.	£	s.	d.
Turf wall	@ 9d. per lin. yd.	2	12	0	7	3	0	14	12	1
Posts	@ 2s. 6d. each	3	2	6	9	2	6	16	15	0
Rafters	@ 2s. 6d. "	3	12	6	12	0	0	26	15	0
Eave and wall plates	@ 1$\frac{1}{2}$d. per lin. ft.	2	3	10$\frac{1}{2}$	6	15	3	13	15	10$\frac{1}{2}$
Laths	@ $\frac{1}{2}$d. per yd.	1	5	0	3	15	0	8	6	8
Thatching	@ 7d. per sq. yd.	5	14	5	17	10	7	35	15	3
Gates (outer)	...	1	10	0	3	0	0	3	0	0
Total cost		20	0	3$\frac{1}{2}$	59	6	4	118	19	10$\frac{1}{2}$
Cost per sheep		0	2	0	0	1	11$\frac{1}{2}$	0	1	11$\frac{3}{4}$

on hand, a stormy winter will have lost all its terrors to flock-masters and shepherds; and when they view their flocks safe and snug, and thriving throughout the most severe or most lengthened snowstorm, they will recall with unfeigned astonishment the days when they thought they were doing well if at

any cost they could bring their exposed sheep through such a period with the bare life in them.

Permanent Wintering Sheds.—While the rough sheds already described are good enough for casual shelter, more commodious as well as more durable structures are advisable if the sheep are to be kept in the sheds all winter. It goes without saying that when wintering-sheds become a part of the regular equipment of a sheep-farm, as must be the case soon, they will fall to be erected by the landlord; and if the tenant is not required to



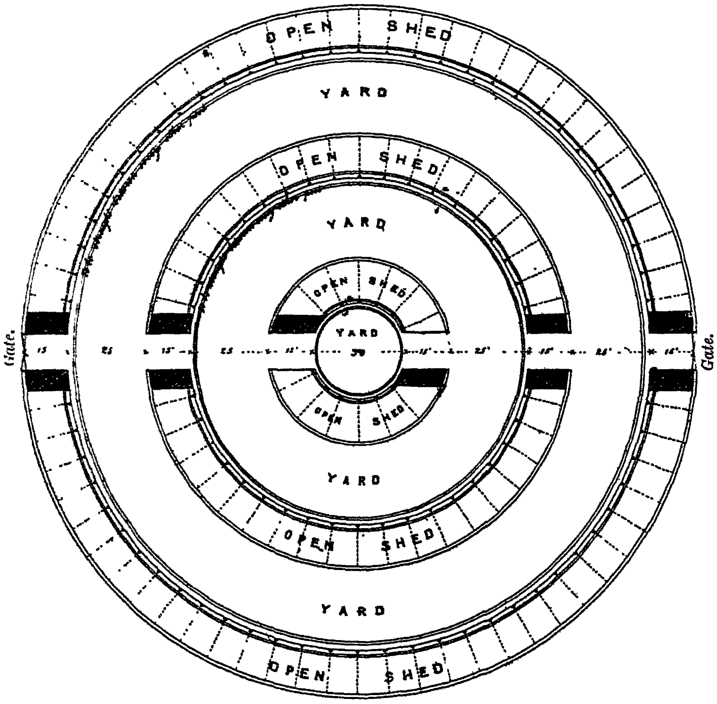
Plan No. I.—Shed for 200 Sheep.
Scale, 20 ft. to 1 inch.
a, Channel for liquid manure; *b*, Channel for rain-water; *c*, Manure-pits.
Rafters and posts are dotted in on the plan.

pay interest on the outlay, he will at least have to keep them in repair, and will not take a farm unless it is provided with sheds of substantial construction. When the necessary outlay is made an annual rent-charge on the farm, the expense of really first-class sheds does not add more to the sheep rental than is paid for one week's grass when the sheep are wintered away from home.

Sheep-sheds of a superior kind can be erected at a cost of 6s.

per sheep or less, and 6 per cent per annum on that outlay adds but 4½d. to the sheep rent. Even if the sheds were only used for laying the sheep into in stormy weather, this trifling expense would be repaid many times over.

For permanent winter quarters, there is no better plan of sheep-shed than the circular one, with its inner side open to the yard; but the sheep require, say, a third more space than is necessary in the sheds which are only for occasional use as



Plan No. II.—Triple Shed for 1300 Sheep.

Scale, 73.3 ft. to 1 inch.

a, Channel for liquid manure; *b*, Channel for rain-water; *c*, Manure-pits. Posts and rafters dotted in. Inner circle of posts 6 feet apart; middle do., 7 feet apart; outer do., 8 feet apart.

storm-shelters; and to keep off foot-rot, which is the worst enemy of sheep when wintered in sheds, the floors should be laid with hard concrete, which can be swept clean daily, so that no litter of any kind need be used. These and other improvements are embodied in the accompanying plans, which are for sheds 15 feet in width, having walls built with stone and roofs covered with galvanised-iron sheets.

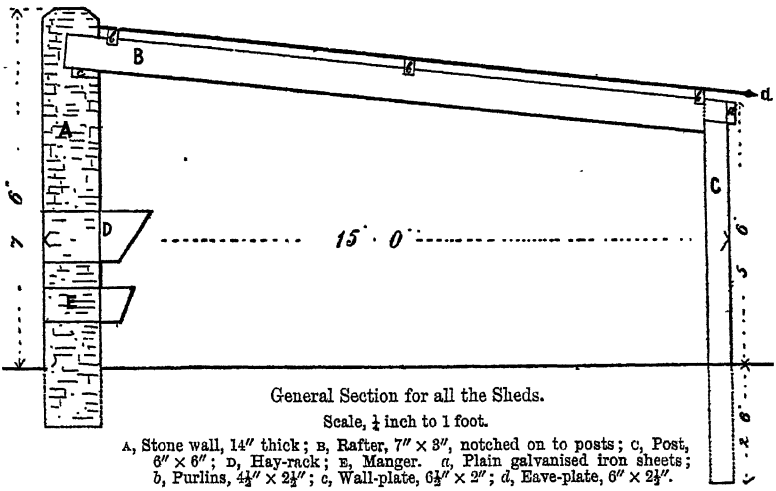
The general section explains the construction of the sheds more clearly than any words can do, but the following specification may be useful to some readers (see Table II. as to costs):—

Walls to be built with rough stone, dashed with lime-mortar on both sides; and four rows of pegs to be built into the wall, with 6 feet between the pegs in each row, for fixing hay-racks and feed-troughs or mangers, as shown in section.

Roofs to be covered with plain galvanised iron; sheets to overlap 6 inches; joints to be double riveted.

Floors to be bottomed with 6 inches of broken stones, and covered with Portland cement concrete of 1 to 7—one of cement to seven parts of crushed bricks, clinkers, or stone-chips, such as will pass through a ¼-inch mesh.

Channels, 5″ × 2½″, to be made in concrete, thus: 



General Section for all the Sheds.

Scale, ¼ inch to 1 foot.

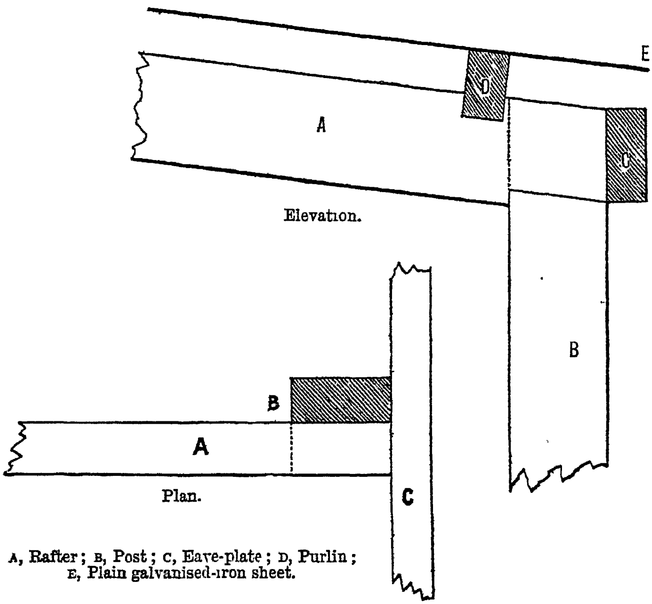
A, Stone wall, 14″ thick; B, Rafter, 7″ × 3″, notched on to posts; C, Post, 6″ × 6″; D, Hay-rack; E, Manger. *a*, Plain galvanised iron sheets; *b*, Purlins, 4½″ × 2½″; *c*, Wall-plate, 6½″ × 2″; *d*, Eave-plate, 6″ × 2½″.

(*a*) in sheds, running to manure-pits; (*b*) in yards, running to drains, as shown on ground-plans.

Manure-pits, to be formed in concrete, 15′ × 4′ × 2′, under shed-cover and next gateways, to receive drainings from the sheds, and into which all dirt and droppings on the floors can be swept daily.

Fitting up the sheds with permanent hay-racks will add about 1d. per sheep to the cost of above, and fixed troughs or mangers about 3d. per sheep more. For hill-flocks the mangers are not absolutely needed; but even in their case, if not used for box-feeding, the mangers would be useful in preventing waste of hay from the racks by its getting amongst the sheep's feet, and as the sheds might be used for other sheep at times

when the hill-flock was not in winter quarters, it would be well to have the mangers there. Both racks and mangers are easily fitted to the pegs built into the wall, as already explained. To the ends of each of the two upper rows of pegs nail a 2-inch spar, and to the spars fix an 18-inch roll of ½-inch mesh wire netting, and there is an excellent hay-rack, at a cost of about 1½d. per lineal foot. Between the two lower pegs fit in a 9-inch board against the wall; then in front of that, and pressing tightly against it, on the lower peg nail a 5-inch board, to the front edge of which, and the second row of pegs, nail a 9-inch board,



Details of Posts and Rafters. *Scale, 1 inch to a foot.*

and the manger also is complete, at a cost of about 4½d. per lineal foot.

Water-troughs should be placed at various points in the sheds, and kept well supplied when the sheep are in quarters. The only other equipments needed to furnish the sheds will be a number of movable hurdles—enough to divide the large sheds into compartments to hold not more than 200 sheep each, also to make a fence between the shed and the yard, when the sheep are not to have the run of the latter, and enough to make a dozen or two of small pens for single ewes at lambing-time. The same hurdles would serve for making sorting-pens when required, on such occasions as shearing, weaning, drafting, &c.

TABLE II.

		Single shed.	Triple shed.			
		For 200 sheep.	For 700 sheep.	For 430 sheep.	For 150 sheep.	For 1300 sheep.
Diameter . . .	ft.	70	220	140	60	..
Circumference . .	"	220	691	439	188	..
Gateway . . .	"	12	24	24	24	..
Outer wall . . .	"	208	667	415	164	..
Width of shed . .	"	15	15	15	15	..
Inner circle (posts) .	"	113	510	321	94	..
Shed area . . .	sq. yds.	267½	981	613⅓	215	1809⅓
Shed area, per sheep .	sq. ft.	12.04	12.61	12.54	12.09	12.52
Stone wall . . .	lin. yds.	69⅓	222⅓	138⅓	54⅔	415⅓
Posts (pitch pine) .	lin. ft.	152	528	336	112	976
Rafters (redwood) .	"	275½	957	609	203	1764
Purlins (redwood) .	"	481	1765	1104	387	3256
Eave and wall plates .	"	321	1177	736	258	2171
Galvanised-iron sheets	sq. yds.	267½	981	613⅓	215	1809⅓
Concrete flooring (shed)	"	267½	981	613⅓	215	1809⅓
" " (yard)	"	(part) 139½	(part) 375	(part) 250	(whole) 78½	703½
Gates (outer) . .	No.	1	2	2	2	6

APPROXIMATE COST.

		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Stone wall .	@ 2/6 per lin. yd.	8 13 4	27 15 10	17 5 10	6 16 8	51 8 4
Posts . .	@ 9d. per lin. ft.	5 14 0	19 16 0	12 12 0	4 4 0	36 12 0
Rafters . .	@ 3d. " "	3 6 6	11 11 0	7 7 0	2 9 6	21 7 6
Purlins . .	@ 1½d. " "	3 0 1	11 0 7	6 18 0	2 8 0	20 6 7
Eave and wall plates	@ 2d. " "	2 13 8	9 16 2	6 2 10	2 3 0	18 2 0
Galvanised-iron sheets	@ 1/6 per sq. yd.	20 1 3	73 11 6	46 0 0	16 2 6	135 14 0
Shed flooring .	@ 9d. " "	10 0 7½	36 15 9	23 0 0	8 1 3	67 17 0
Yard flooring .	@ 9d. " "	5 4 7½	14 1 3	9 7 6	2 19 3	26 8 0
Gates (outer) .	..	1 15 0	3 10 0	2 0 0	2 0 0	7 10 0
	Total cost .	60 9 1	207 18 4	130 13 2	47 4 2	385 15 5
	Cost per sheep	0 6 0½	0 5 11½	0 6 0¾	0 6 3½	0 5 11

Continuous Hay-feeding in Winter.—Shed-wintering implies continuous hay-feeding, which hill sheep need as much as shelter. Thousands of them die every winter from sheer starvation, and the survivors are often so reduced in condition that it takes them most of the grass season to pick up again. There is also a heavy loss of wool; as not only the quantity, but also the quality, of the wool raised depends almost entirely on how the sheep have been wintered. If they are ill-conditioned and lean at the beginning of the grass season, the wool will be inferior in quality and light in weight.

Some hill pastures are of such a nature and variety that the winter must be a very bad one indeed if the sheep fall away much before Candlemas. The majority of grazings, however, are not of this class; and in the spring months even the best grazings are not capable of maintaining nearly the number of sheep that they will do through the rest of the year. In very many cases the hoggs are sent away to low ground for wintering; but often the object of doing this is that the hoggs may escape the ravages of braxy and other scourges of the hill-flock to which they would be subject if left on the hill. The cost of wintering for hoggs averages about 6s. 6d. per head, and adding to that say 3s. 6d. for the home-rent, it makes the hogg-rent 10s., which is more than half the value of a hill hogg at present. Nor is the expense of sending the hoggs away the only objection to that system. Hill sheep away wintering have all to be removed from the low ground by the first week in April, and if sent to the hill then, as they generally must be on returning home, there is no grass for them, and by the end of April they have often lost the whole benefit of their wintering. This last consideration, together with the scarcity of good grass wintering, and the great expense of wintering of any sort for hill sheep on low ground, make it most imperative that the hoggs should be wintered at home. And the only way of doing this satisfactorily is by shed-wintering and hay-feeding. With plenty of hay made on the farm, hill sheep can be brought well through the winter on that alone. Nothing else will supply the want of it. Corn, cake, and turnips are too costly for hill sheep; and besides, they do not thrive nearly so well on the hills afterwards as they do when they have been wintered on their native hay alone at comparatively little expense.

The farmer puts up every summer about 4 tons of hay per 100 sheep for storm-feeding in winter, and then thinks he has done enough to make up for the difference between the winter and summer value of the pasture. But this quantity of hay never suffices for storm-feeding even, when the winter is a severe one. And hay-feeding in time of snowstorms does nothing to make up for the winter failure of the pasture. This

is proved by the fact that storm-feeding cannot save the hoggs from exceptional winter mortality, the only remedy being to send them away to lower ground. And storm-feeding does very little for the sheep left at home. The hay is usually withheld until the eleventh hour, in the hope that the storm will break up and hay-feeding can be done without; then, as soon as the snow begins to disappear again, the hay-feeding is stopped, and the sheep have to subsist, if they can, on the frost-withered herbage of the hills.

Hay-feeding, to be of any benefit, must be begun early; when once begun it must be given regularly; and care must be taken not to stop the hay until there is plenty of grass in spring. Partial feeding, as is practised at present, is worse than none at all, as the sheep wait on it and no longer search for their native food with their wonted avidity. Even storm-feeding makes hill sheep worse at standing out to "work" for themselves when the ground is covered with snow. Yet it is well known that where sheep can get at heather or natural grasses, by scraping or otherwise, they will not take to hay. These are seeming contradictions; but as storm-feeding at least must be practised, and as there are few points of more importance in the management of sheep than that they settle quietly and contentedly, the only way of fully meeting the difficulty is to put them on hay altogether.

> "The less their wants, the more each want supply.
> Fence off the icy blast, and snow-fraught sky;
> Scatter their leafy food, nor day by day
> Refuse, all winter long, their dole of hay."
>
> —VIRGIL.

Nothing but shed-wintering and continuous hay-feeding will enable flockmasters to bring their sheep through a severe winter and spring-time in good condition. The changed circumstances of hill-farming, particularly the increased value of young sheep as mutton-producers, demand that more attention be given to the wintering of young stock and breeding ewes. If a ewe does not produce a lamb, her fleece is a very poor return for a year's keep; and the value of a grit ewe depends very much on her ability to start her lamb with plenty of milk, for a lamb that is starved to begin with will never make more than a "pally" at sale-time.

The Expense of continuous Hay-feeding no obstacle to the Shed-wintering of Hill Sheep.—It may be said that it is not practicable to provide the great quantity of hay needed to give a hill-flock a full daily ration of it for, say, five months of winter, and that if the hay could be got the expense would be far too great. This might be so if the hay had to be bought; but it is different when the hay is made on the farm, as it can be, and ought to be.

Giving a full ration of 2 lb. per day for 140 days—or what practically comes to the same thing, 2 lb. of hay for 121 days and from $\frac{1}{2}$ lb. to $\frac{3}{4}$ lb. for other 60 days, making 181 days or six months of hay-feeding in all—each sheep will require 280 lb. of hay to winter it, and a hirsel of 30 score will need 74 tons. As the cost of hay made on hill-farms is not more than 12s. per ton (rent of hay-ground included), the expense of raising 74 tons will not exceed £44, 8s., or 1s. 5$\frac{3}{4}$d. per sheep! Say that it costs 1s. 6d. per head to feed hill sheep all winter on hay made on the farm, the expense for 600 sheep is only £45. What a trifle in comparison with what has to be paid if the hay has to be bought during a storm, when hill-farmers have often had to spend as much as £45 on hay to carry a single hirsel of sheep over the short period of three weeks. In 1859-60 some flockmasters laid out about twice the amount of their yearly rent on purchased food alone, to tide the sheep through that disastrous winter. And before me now lies the balance-sheet of a hill-farm, carrying 600 sheep, from which it appears that the outlay on purchased hay to sustain the flock during the stormy spring of 1886 amounted to no less than £74, or 2s. 4d. per sheep! In the case of another hill-farm, carrying a stock of 2400 sheep, the accounts show that the outlay for purchased hay during the last twenty years has averaged £120 per annum, or 1s. per sheep. These outlays, remember, are merely for hay-feeding during occasional snowstorms, and go very little way towards a full winter provision for the sheep. When the hoggs are sent away to wintering, it costs nearly as much for them alone as would keep them at home and provide six months' hay-feeding for every sheep on the farm.

How important it is, then, that every hill-farm should be made to produce enough of hay to winter its own flock. The very existence of store-farming in this country depends on this being done. All farms, of course, do not yield natural hay in the same abundance; but every farm that has summer pasture for sheep is capable of yielding hay to winter them. If the bogs do not give enough of hay, three or four fields to every hirsel should be fenced off the lower part of the hill for the express purpose of raising it. Even on farms where abundance of bog-hay can be cut, there should be a hay-park or two, to furnish some finer hay to keep till late in spring, for the sheep do not eat coarse bog-hay so readily then as they do in mid-winter. It might be better in every case to raise all the hay in parks, as in a dry summer the sheep might suffer if the bogs were mown very bare. Forty acres of upland meadow or park land will yield sufficient hay to winter 600 sheep, if the parks are mown every year, as they can be when all the hay is fed on the land which grew it. When the summer is wet and unfavourable for hay-

making, some of the grass can be made into silage; but when hay can be made, there is nothing to be gained by ensiling the grass.

Say that by the end of October, at latest, all the sheep are taken off the hill and brought in to the hay-parks. These having been hained since they were cut for hay will be rough of grass, and if folded over at the rate of about a quarter acre per day to 100 sheep will keep the flock a month—at the same time laying the sheep into the sheds at night, and giving ½ lb. hay to each. The rams should be put to the ewes the first week they are in the parks, and by the end of November the rutting season would be well over. By that time also the parks will have been folded once over, and the sheep should then be put into the sheds altogether for the winter and get their full ration of hay. At the end of March, instead of sending the sheep direct to the hills, fold them over the parks again during April, and lay them into the sheds at night with ¾ lb. of hay to each. Lambing would begin the first week in April, and two or three of the parks could be specially reserved for ewes and lambs. By the 1st of May the lambing would be about over, and there would be plenty of grass on the hills after they had been hained for six months. The sheep could then go out to their summer pasture in good condition, and with all the risks of a hard or late spring-time safely over.

Enriched by the autumn and spring foldings, the parks would cut a heavy crop of grass for hay without more manure, but the poorest spots of ground would get the shed manure in addition to the foldings. The whole of the grass cut for hay would thus be fed as it were on the 40 acres which yielded it; and, in keeping 600 sheep for six months, every one of the 40 acres would get a manuring equivalent to the folding on it of 2700 sheep for one day and one night. After the spring folding the parks would be shut up till hay-time; and after the hay crop came off they would be hained again until the sheep came in for the first folding at the end of October. Four months of winter, with its frosts, and snows, and rains, would intervene between the autumn and spring foldings, to sweeten the grass and purify the ground; and the hay-crop coming between the spring and autumn foldings would destroy all rankness and keep the land sound for sheep.

Advantages of Shed-wintering and continuous Hay-feeding combined.—It is too much to expect that flockmasters generally will approve of shed-wintering for hill sheep; but all must admit that nothing conduces more to the healthy and profitable condition of a flock than shelter and dry lairs, with plenty of hay-feeding in winter. The exposure and starvation to which hill sheep are subjected under the present system of wintering calls

loudly for improvement, and I do not doubt that the simple and advantageous practice here recommended will become more approved the more it is known and adopted. No one can fail to see the importance of erecting shed-shelter for the sheep during winter, and the reason why it is not more generally practised seems to be because of some fallacious idea of its unremunerative costliness. The fact is that the cost of putting up sheds for all the sheep is a mere trifle compared with the advantages gained. It has been shown that the annual charge on the outlay for sheds of the best class is only 4½d. per sheep, or £10, 16s. for 600 sheep. On the other side of the account there will be 5 per cent less mortality in the flock, 10 per cent more lambs, 10 per cent better lambs, 10 per cent more wool, 5 per cent better wool, and 10 per cent better draft ewes—representing an increased return of £99, 6s. from 600 sheep, or a balance of £88, 10s. in favour of shed-wintering.

Cost.

Interest on erection of sheds for 600 sheep, 6 per cent on £180	£10	16	0
Balance in favour of shed-wintering	88	10	0
	£99	6	0

Advantages.

5 per cent	less mortality,	30 sheep at	20s.	each . .	£30	0	0
10 "	more lambs,	48 lambs "	10s.	" . .	24	0	0
10 "	better lambs,	432 lambs "	1s.	" . .	21	12	0
10 "	more wool,	480 fleeces "	4d.	" . .	8	0	0
5 "	better wool,	480 " "	2d.	" . .	4	0	0
10 "	better draft ewes,	117 ewes "	2s.	" . .	11	14	0
					£99	6	0

The cost of hay is not charged here against shed-wintering, for the simple reason that the hay bill costs as much under the present system of merely storm-feeding out of doors as it would do if the sheep were hay-fed all the winter in sheds. Every flockmaster makes a practice of putting up 20 to 30 tons of hay annually to each hirsel, at a cost of about 6d. per sheep. I have also quoted facts to show that when this home-made hay runs short during a snowstorm, as it does in many years, and hay has to be bought at £5 or £6 per ton, this sometimes adds as much as 2s. 4d. per sheep to the expenses, while the average annual outlay for purchased hay is about 1s. per sheep. Under the haphazard system of wintering now pursued, then, the home-made hay and the purchased hay together cost 1s. 6d. per sheep; and we have ample proof that the sheep can be shed-fed all through the winter on home-made hay for no more money. There is the further consideration that when the hoggs are

wintered away from home, as is very generally done at present, it adds 1s. 3d. to the cost of wintering every sheep on the farm. This is another £36 in favour of shed-wintering.

Then there is the undoubted fact that with continuous hay-feeding from October to April every sheep in the flock will be 10 per cent better in condition than with the intermittent feeding given at present. But even if nothing is charged against the present system for home-made hay, purchased hay, and wintering the hoggs away from home, and if the £45 worth of hay needed for shed-feeding is charged in the foregoing account, there still remains an increased annual return of £42, 10s. in favour of shed-wintering, besides all the sheep on the farm 10 per cent better in condition.

Shelter for Sheep on Arable or Enclosed Land.

Sheep on arable farms usually get an ample provision of winter food made for them, but they are as much in need of shelter from wintry blasts as hill sheep are. Anything more pitiable than a flock of sheep huddled up against the flakes in a pelting rain or drifting snow, or with the wool draggled to their backs almost in the mud of a wet turnip-field, cannot be met with on the hills even at mid-winter. And hill sheep and park sheep have this much in common—it is an imaginary necessity of making them feed off something on the land which prevents both of them from getting the maximum of shelter desirable.

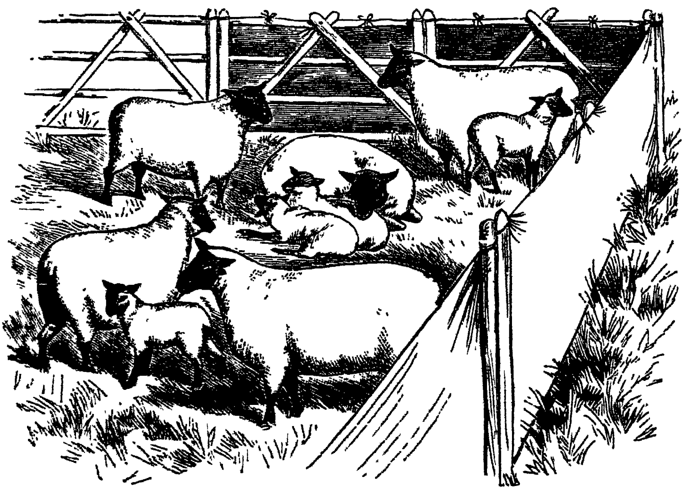
The hill-farmer, as we have seen, does not succeed in making his land keep the sheep by keeping them on the hill all the year round; though it can be done by keeping them off the hill all winter.

In very much the same way sheep on arable land are made a sacrifice of in order that the green crops may be fed on the land; and the sacrifice may be termed a double one, for it generally includes the crop as well as the sheep. The sheep-husbandry of arable farms, indeed, is largely based on a blind observance of practices which were suitable enough when the main purpose of a flock was to serve as a manure-cart to outlying fields, but which are not suitable now when the principal object of sheep-keeping is to raise mutton. The sheep is not a working animal, yet the flock is still made to do a great deal of manure-cart work, which can be done more cheaply by other means. This is the great obstacle to providing the requisite amount of shelter for sheep on arable land. But if the maximum of shelter is desirable for hill sheep, it must be still more so for sheep which are artificially fed all the year round. How this can be attained, and at the same time the

green crops be fed to the greatest advantage, is what we have now to consider.

Sheep on Turnips.—Sheep folded on turnips suffer severely from the storms of winter, but never so badly as when there is a week or two of continuous wet weather, or at the breaking up of a snowstorm, when the ground is a complete slop. No one has yet been able to devise an efficient, convenient, and practicable shelter for sheep while feeding upon the turnip-break. Still something in the way of temporary shelter is always possible, and "a sma' bush is better than nae beild."

The sheltering-cloths, made by Messrs Rands & Jeckell, Ipswich, for fixing to hurdles are a good protection against cold winds, and can be easily and quickly moved in case of the



Sheep and Lamb Sheltering-Cloths.

wind changing. On the sheltered side of the cloth-covered hurdles the sheep can lie and rest in comparative comfort even when there is a rough drift. But wet is far more hurtful to sheep than mere cold, or dry winds, however boisterous, and much more than side shelter is needed.

With a few wattled hurdles, poles, and a little straw, without nails or framework of any kind, I have seen cheap covered shelters erected in the turnip-field. These temporary sheds could be readily shifted as the fold moved forward, but they were mere huts, and could not be made large enough to enable the sheep to be fed within them on cut turnips out of boxes. Thus, although they afford a kind of covered shelter to the sheep against rain and snow and cold winds, there is the same fatal

objection to them as there is to open stells for hill sheep—that is to say, if the sheep are to take full advantage of them, they must often be lying in the shelters when they should be feeding. The right sort of shelter is that which enables the sheep to feed as well as rest in comfort, and there seems to be no practicable means of affording this to sheep on turnip-land, especially in wet weather.

Instead of erecting temporary and partial shelters, which are never much good, it is much better to winter the sheep in sheds, and feed part of the turnip crop to them there. It is objected that this entails the heavy expense of carting the crop to the sheds, and the manure back again; but this expense can be greatly diminished by folding the sheep on the turnip-break in dry weather, during October and November, and again in March and April, so that roots have only to be carted for the three months December, January, and February. During these ninety days of root-feeding in the sheds, the sheep would be getting, say, 1½ lb. of hay, and would not consume more than 10 lb. of cut roots each daily. At this rate only 40 tons of roots to every 100 sheep would need to be carted to the sheds. During the other ninety-six days of winter (forty-five in autumn and fifty-one in spring) the sheep would eat their green food on the land by day, and come into the sheds at night to a feed of hay. The cost of carting the turnips to the sheds, and the manure back again, would amount to about 30s. per acre, and the saving of food alone by shed-feeding would be enough to cover that expense, without reckoning any benefit to the sheep from being under shelter.

	Per acre.
Pulling turnips	£0 6 0
Carting turnips to sheds . . .	0 18 0
Carting manure back to field . . .	0 5 0
Spreading manure	0 1 0
	£1 10 0

It will be shown, in connection with shelter for fattening sheep, that one-fourth less food is absolutely consumed, and relatively nearly twice the increase of mutton made, when the sheep are fed in sheds instead of in the field in winter; and it must be a poor turnip crop indeed that is not worth more than four times 30s.

One-half the acreage of turnips usually grown for sheep, if carefully lifted, stored, and fed cut, would keep as much stock as the full quantity now grown keeps in the way it is wasted. Not more than one-third of the turnips for sheep are ever stored in any shape or form; and of the remaining two-thirds I am afraid to say what percentage rots in the field, after having

been frozen, or gnawed by hares and rabbits, or pecked by wood-pigeons. Numerous analyses of frosted and unfrosted roots show that in feeding value 5 tons of the latter are equal to 6 tons of the former. That is a loss of 16.6 per cent, when the turnips have merely had one nip of frost and been thawed again; and if the turnips are fed in the frozen or icy state, as they very often are fed to sheep in the field during winter, the loss may be twice as great, because a much larger portion of the carbohydrates is consumed in raising the temperature of the frozen roots to blood-heat; while, if not fed until the spring, the unstored turnips will have been frozen and thawed many times over, and may have parted with the whole of their feeding value, nothing being left but worthless woody fibre. In this state turnips are sometimes the cause of fearful losses amongst lambing ewes in spring.

If turnips are not worth taking care of when grown, or if they are not fed for all that they are worth, they are not worth growing at all. Making allowance for every benefit to the land consequent on the cleaning, cultivation, and manuring bestowed in turnip-culture, and from folding the crop on the land, there is no blinking the fact that there are cheaper and equally valuable substitutes which are not so liable to waste. Vetches, for instance, can be grown at half the expense of turnips, and are of far superior feeding value. It costs 1d. a-day to feed a sheep when folded on turnips in the open field, and the same sheep can be equally well fed on vetch-hay or vetch-silage for one-third of a penny.

Sheep wintered on Grass.—Where sheep are being grass-wintered on low ground it is much easier to find partial shelter for them than for sheep on turnips. There is generally some part of a grass-field less exposed than the other parts which can be taken advantage of, and temporary sheds of a more useful kind can be erected on grass-land, where they do not need to be shifted about as in the turnip-field. Very inexpensive sheds can be run up to meet the case here. A thatched roof upon posts 5 feet high, the space between the posts on the north side being filled in with two rows of wattled hurdles, one on each side of the posts, and rammed between with straw, is all that is required. But the sheep cannot be sheltering in these sheds and at the same time feeding on the pasture, and if they are to be put into wintering-sheds altogether, and fed on hay and roots, it will be found decidedly better and cheaper in the end to have permanent wintering-sheds erected on the same plan and construction as those recommended for hill-flocks. If this is done on enclosed land, however, it will, in most cases, be desirable, in preference to having one large shed, to have three

or four small ones located on different parts of the farm, for convenience in drawing green crops to them or folding the sheep on the adjacent fields during the daytime in dry weather.

Generally speaking, most of their food has to be carted to sheep that are wintered on grass-fields, and it is just as easy to cart it to the sheds. More than this, neither old sheep nor lambs can be wintered with any certainty of success on grass-land which has been thickly stocked with sheep the previous summer. Much of the grass-land is also rather doubtful as to soundness for sheep in winter, and in all such cases it is the wiser plan to house the sheep in open sheds, where they will be protected from the winter weather, and can be provided with dry and nourishing food. Not one of the 5,000,000 sheep carried off by liver-fluke during the epidemic of 1879-82 would have been lost if the sheep had been shed-wintered; and this appalling loss, it will be remembered, fell almost entirely on arable-farm flocks.

Shelter for Lambing Ewes.—On all lowland farms, yards and covered pens of some kind are deemed essential for the ewes at lambing-time. Temporary erections are generally made for the occasion; but where sheep-breeding is regularly carried on, nothing but permanent sheds will enable the flockmaster to cope successfully with severe seasons. The ordinary wintering-sheds answer the purpose admirably. They have ample covered shelter for all the ewes; a few movable hurdles suffice to make all the necessary pens and subdivisions; and the concrete floors render them far healthier and safer quarters for the ewes than any temporary erections ever can be. Where there are no permanent sheds, of course, much in the way of providing shelter may be done by erecting a temporary lambing-fold and pens with thatched hurdles, but it is a poor makeshift in wet weather or during a snowstorm. Besides, a temporary lambing-fold and covered pens, for, say, 400 ewes, can seldom be erected, littered, and removed again for less than £7, 10s., even when hurdles and straw are the only materials used; and this amounts to 4½d. per ewe, which is enough, as we have seen, to pay the annual charge on the erection of permanent sheds of a much more comfortable and satisfactory kind.

Some of the temporary lambing yards and pens which are annually erected in the south of England, with long stacks of straw bounding both the north and east sides of the enclosure, and both yards and pens well littered with straw, cost as much as £10 or even £20, without reckoning the value of the straw. They are very comfortable-looking quarters before the sheep go in, but they cannot be kept clean in wet weather, and if fever or inflammation breaks out amongst the ewes, no more dangerous

lodging for them could be devised. Therefore, from all points of view—comfort, sanitation, and cheapness—none of these temporary erections will at all compare with the clean, dry, and airy wintering-sheds shown on pages 115, 116.

Shelter for Young Lambs in the Field.—All young lambs are the better for being kept a night or two in the shed or yard-pens before they are sent out to the fields with their dams. A single night in the pens is often the means of setting young lambs fairly on their legs. But when they are turned out to the fields they should also be able to find plenty of shelter from the cold winds and during snowstorms or wet weather. If a thatched hurdle is set up with its back to the wind, then two more transversely to and against the first, at opposite ends of it, and another thatched hurdle or two be laid horizontally on the top of the others and fastened there, this will give covered shelter to a dozen or more lambs, with little labour and at a very nominal expense. A number of these shelters should be erected all over the field if it is pasture; and if it is a turnip-fold, the shelters are easily moved forward along with the sheep. In the latter case, the fold will be warmer if the hurdles which form it are covered with the sheep sheltering-cloths referred to at p. 126; but the hurdle-shelters for the lambs are necessary in addition to that.

The Economy of Shed-feeding in Winter.—Every one knows that the economy of feeding is greatly improved by sheltering sheep. This is as true in regard to store sheep as to fattening sheep; but it is difficult to estimate the advantage except in the case of sheep that are being fed for the butcher. It has been found over and over again, that a fattening sheep in the open field will gain, in live-weight, 2 lb. per week in fine weather; while in bad weather it will not gain at all, no matter how well it may be fed. The loss which may thus occur in the course of a single week, in a large flock, is far more than is required to provide shed-shelter for all the sheep.

A sheep folded on turnips in winter uses about 40 per cent of all the food it consumes to maintain the heat of its body. But if this heat is maintained artificially, or, in other words, if the waste of it by excessive external cold is diminished by shelter against wintry winds, the necessity for this enormous loss by combustion within the lungs of the animal will also be diminished, and a great saving of food follow.

A series of experiments made by M. Ch. Richet upon rabbits shows, in a curious but striking manner, the relations which subsist between the quality of food required by an animal and its power of maintaining its normal temperature, also the need of a covering, natural or artificial, as a protection against cold.

Two rabbits were placed in a cool chamber (between 50° and 60° Fahr.) The larger and heavier of the two was kept constantly shorn, and the weight of food which each consumed was ascertained daily. For two weeks the shorn rabbit resisted the cold, eating every day at least one-third more than the unshorn one, yet losing constantly in weight, while the other one gained. During this time the temperature of the shorn animal was about half a degree less than that of the unshorn one. After two weeks the organism of the shorn rabbit became unequal to the task of producing heat, the temperature fell, and on the nineteenth day the animal died. During this short period it had lost more than one-sixth of its weight.

Liebig, in his work on animal chemistry, was the first to accurately define the source of animal heat, and the constituents of the food used in its support. He showed that warmth is an equivalent for food, to a certain extent, and that cold, on the other hand, renders necessary a greater supply of food by carrying off rapidly the heat which its combustion engenders. He also pointed out that motion is always accompanied by a waste of matter in the body, and that an economy of food is necessarily the result of an economy of motion.

Experiments upon feeding sheep in sheds amply confirm these theories. The warmth communicated by the sheds is equivalent to a certain amount of food, and the deprivation of motion causes a diminished waste of the tissues of the body, and therefore a corresponding saving of aliment. No better practical illustration of these views can be given or asked for than is afforded by the following experiment with sheep belonging to Lord Ducie, and which was communicated to the Royal Institution by Playfair, many years ago now. Five lots of sheep, each lot consisting of five sheep, were experimented on as follows:—

No. 1 lot was fed out of doors, and was therefore exposed to all the influence of atmospheric changes.

No. 2 lot was kept under an open shed, and therefore was less exposed to the inclemencies of the weather.

No. 3 lot was placed under an open shed, similar to the last lot, but in this case the sheep were kept solitary—*i.e.*, each was confined to a space of 3 feet by 4 feet.

No. 4 lot was placed under a close shed in the dark.

No. 5 lot was kept under a shed like No. 4, except that each sheep was separated, and confined to a space of 3 feet by 4 feet.

These different lots were allowed ½ lb. oats for each sheep per day, but were supplied with as many cut swedes as they felt disposed to eat, the weight consumed by each lot being accurately determined. The live-weights of the sheep were

ascertained before the commencement, and at the conclusion of the experiment the results were as follows:—

	Average live-weight per sheep.		Increase per sheep in live-weight.	Weight of roots consumed per sheep.		Increase in live-weight for each 100 lb. of roots eaten.
	Nov. 18.	March 9.		In 111 days.	Daily.	
	lb.	lb.	lb.	lb.	lb.	lb.
1	108	$131\frac{1}{3}$	$23\frac{1}{3}$	1912	$17\frac{1}{3}$	1.2
2	104	$132\frac{2}{5}$	$28\frac{2}{5}$	1394	$12\frac{1}{2}$	2.0
3	108	$130\frac{1}{5}$	$22\frac{1}{5}$	1238	$17\frac{1}{7}$	1.8
4	102	$129\frac{4}{5}$	$27\frac{4}{5}$	886	8	3.1
5	111	$131\frac{3}{4}$	$20\frac{3}{4}$	886	8	2.4

In the consideration of these experiments we may refer to the "roots" alone, as the quantity of corn supplied was in all cases the same.

"It will be seen that the first lot, or that which was exposed to the cold, ate double the quantity of swedes consumed by the sheep fed in a dark warm shed. Exposure to cold winds extracted heat so rapidly from the bodies of the sheep that a large amount of food was necessary to support their proper temperature. That this excess of food was wholly employed for this purpose, and entirely lost as far as the farmer is concerned, is obvious, for the absolute increase of weight of the first and last lots is nearly equal, although the relative increase for the food consumed is much in favour of the latter. Thus, also, it will be seen that although the second lot received 518 lb. of food less than the first, yet that lot reached a greater weight both absolutely and relatively.

"The second lot had the protection of a shed, and therefore did not require so much food to keep up the proper temperature of their bodies as the exposed sheep. In these two cases, both lots were treated similarly as to exercise. In lots 3 and 5 each sheep was confined to its own allotted space of 12 superficial feet, but without advantage, probably from disturbing the placid temperament of the animals, as they were observed to fret and lose their appetite when thus separated. The result attending the experiment with the fourth lot is highly interesting. The sheep forming this lot were confined in the dark. In this state there were no inducements for the sheep to move about, or even to remain in a waking state, except when impelled by hunger to eat food. Hence they passed much of their time in sleep. During sleep the voluntary motions ceased, and there was small waste of the tissues of the animal, which now possessed almost entirely a vegetative life, and increased rapidly in size, with small consumption of food. Although eating con-

siderably less than half of the food consumed by those sheep which were exposed to the weather and to the causes of waste produced by voluntary motion, this lot increased more in absolute weight at a relative economy of food nearly three times as great."

Here is conclusive evidence that shed-wintered sheep eat much less, and yet produce much more mutton in proportion to the quantity of food consumed than others fed in the open field, exposed to all varieties of weather, and inclined to take much more exercise. In the words of an old shepherd, who was greatly against shed-wintering at first: "The sheep dinna eat abune the hauf o' the meat they did oot-bye, and still's a lang way better than ever they wur for baith mutton and 'oo."

RAISING NEW BREEDS OF CEREALS.

By A. N. M'Alpine, Botanist to the Society.

Improvement of Cereals.

A seed or a grain has the property of transmitting to its offspring certain peculiarities derived from its parents—that is to say, certain peculiarities are hereditary and capable of transmission by seed. The business of the breeder is to produce a strain of seed possessing the most desirable qualities, so thoroughly fixed that they are transmitted without change to the offspring. Unless this fixity of character has been secured, the seed is worthless for crop production by the farmer.

In practice, cereals can be improved by four methods:—

1. Cultivation in suitable soil and climate.
2. Selection.
3. Spontaneous variation.
4. Crossing of varieties.

Cultivation.—Cultivation has for its main object perfect nutrition of the breed, to secure which special attention must be paid to tillage, sowing, and manuring, for on these three factors depend the water supply, the food supply, and the air supply of the plant; defect in any of these respects entails diminished quality and defective breed. The management should be of such a nature that the vegetative and reproductive parts are duly proportioned, neither excessively developed at expense of the other.

The soil should be free from weeds, and as deep as possible; cleanness allows the plant to become luxuriant and fertile,

while depth of soil regulates water and air supply. The seed should be sown in rows, but not so thin as to produce giant ears out of all proportion to the rest of the plant; sowing in rows secures sufficiency of light, and nutrition, so far as carbon assimilation is concerned, is at its best. The manures should be of such a nature and so proportioned that the vegetative parts of the plants are fully developed, yet not excessively favoured at expense of the ear and of the seed.

At Newton-le-Willows, Lancashire, Messrs Garton raise and fix their breeds on a gravelly soil of the red sandstone formation; soil depth ranges from four to seven inches. The seed of each breed in process of fixing is sown in rows, limited to a length of ten yards. The manures used are dung and lime—dung at the rate of 20 to 25 tons per acre. Artificials are not applied; the cereals are thus bred on the dung and lime mixture.

The rotation is: (1) Potato, (2) Cereal, (3) A different cereal, (4) A different cereal, (5) A different cereal, (6) Potato, &c. Appropriate cultivation is thus a general method of cereal improvement, useful and subservient to all the other methods.

Selection as applied to Cross-breeds.—The method of selection has full scope only when cross-breeds are being dealt with, for these are endowed with sportive character in highest degree; it is, indeed, their special prerogative to sport and to vary; by this feature they are recognised as truly crossed. Plates I., II., III., IV., and V. exemplify this sportive character.

Breeds of cereals in ordinary cultivation are, of necessity, fixed: here sportive variations are the rare exception, not the rule. The varieties of a new cross exhibit, it may be, improvement on the parents; it may be, deterioration. The skill of the cross-breeder is accordingly exercised in distinguishing improved and suitable from worthless or, at least, less valuable variety. One variety has to be kept, and many cast aside; this is selection—a process of weeding out. Seed produced by the selected plant is sown, and weeding out repeated. Plates V. and XII. show some of the products from which selection has to be made.

This process of selection from the self-fertilised products of a single crossed seed must be continued for a series of years, till the reaction set agoing by the introduction of new pollen has completed itself, till disturbance has subsided, till tendency to reversion has become almost completely annulled, till fixity has been attained—that is to say, till the desired characters have become thoroughly incorporated in the very embryo of the seed. The law for cereals is this—the more violent the change, and the greater the improvement of the breed, the longer is the time required for fixing. On Plate XI., for ex-

ample, spikelets of oat are figured; those at the top of the plate are most improved and most difficult to fix.

A series of years must accordingly elapse before an improved breed can be put upon the market, and further selection must be made before the cross can be utilised by the farmer, since he can only afford to sow seed for crop production when assured beforehand of the nature of the resultant produce. The golden rule regarding "change of seed" is this, do not change because some one else does so, neither because you are advised to do so, but because you know from actual trial that the change will yield a more profitable crop. It is incumbent, therefore, upon our agricultural societies and upon our agriculturists to finish and to crown the work of the cross-breeder by finding ways and means for testing the value of the fixed cross-breeds, their advantages or disadvantages, when grown in the different districts of this country, in the various soils and climates. Like the breeder himself, they must select the best and the most suitable.

Selection, when its advantages are fully realised, has thus two phases:—

1. Selection by the breeder.
2. Selection by agricultural societies and by agriculturists.

Selection as applied to Old Breeds.—All the cereal breeds in ordinary cultivation at the present time are old and fixed, not sportive and variable. Selection of the best from these has proved of considerable value in times gone by.

Hallett and Hunter are the great names in connection with cereal improvement by this method. They took what was already at hand, selected the best fields, and the best ears; the best grains were sown under most favourable conditions, and after a time considerable improvement was obtained. Hunter, for example, took a variety of wheat, and by continuing selection and cultivation for a period of six years, increased the yield per ear from 90 to 124 grains. A certain degree of permanency can thus be given to a selected peculiarity; no really new variety is obtained, but a variety already in existence is made to yield its best by skilful selection combined with suitable cultivation.

"Pedigree seed" of cereals in commerce is obtained from good stocks of ordinary seed by selection—not by hand-picking, but merely by the use of appropriate sieving machinery: the size of the mesh of the sieve determines the size of the seed selected. The sieve is accordingly a most important instrument in connection with improvement of cereal plants. The high-sounding commercial name "Pedigree" implies, in reality, no new breed, but merely selection of the best by means of a sieve.

Spontaneous Variation.—This method takes advantage of the fact that cereals in cultivation occasionally yield a few plants with special peculiarities. Among wheats, for example, some plants may have branching ears as in Plates I., II., III, and IV.; some, special earliness; some, peculiarities of colour, and so forth. If seeds of such are selected and bred for a series of years, fixity may be given to character apparently accidental and spontaneous in its origin. Patrick Shirreff of Haddington successfully applied this method to the production of new varieties of wheat.

"Spontaneous variations," always rare, are most in evidence when different breeds of cereals are grown side by side on the same experimental field; under such circumstances, the "spontaneous variations" turn out, as a rule, to be the result of that rare event in cereal life—*natural crossing*—and the parentage on the male and female side can actually be traced. Rimpau (see 'Landwirthschaftliche Jahrbücher,' 1891) has made a most careful and practical study of natural crossing among cereals, and he describes the cases noticed by himself within a period of fifteen years:—

Wheat, 17 natural crosses.
Barley, 5 natural crosses.
Oat, 5 natural crosses in six years.

With regard to oats, he remarks: "Although natural crosses are more frequent than I formerly supposed, nevertheless they are of no importance in practical agriculture."

"Spontaneous variation" is thus a haphazard method of raising new breeds; improvement obtained by accident must fall far short of what can be accomplished by the art of the skilful cross-breeder.

The potato-oat, so named because it was first found growing in a potato-field, is commonly regarded as an example of "spontaneous variation." This variety turns out, however, to be identical with Turkish sea-oat, and its presence in Cumberland in 1788 may be accounted for on the supposition that the grain was carried in a vessel from the Mediterranean, and from the vessel got into the dung by accident.

Artificial Crossing.—As yet, the method of cereal crossing is in its infancy, and has played little or no part in practical agriculture. Cultivation and selection by hand and by sieve have been the methods relied upon for improvement. Nevertheless, crossing is the most potent improver of all; it not only improves, but provides new breeds and new material for improvement; it takes advantage of the sexual character of plants and combines a portion of one variety with a portion of another. The resultant blend of the two or more selected varieties is the *cross.* Cultivation and selection, however carried out, cannot blend the desirable peculiarities of two or more

varieties into one, but crossing can, and therein lies its power, therein its greatness; thereby it is distinguished from all other methods of improvement.

It must not, however, be forgotten that cross-bred cereals may show deterioration, side by side with improvment; accordingly, selection by the breeder and selection by the agriculturist must always be the handmaidens of cross-breeds if their full value in practical agriculture is to be realised.

Crossed wheats were produced by Mr Maund and by Mr Raynbird as far back as 1846, and these crosses attracted some attention at the Exhibition of 1851. Messrs Carter have also bred crossed wheats; their experiments commenced in 1882, and have continued till the present time. During 1889 eleven varieties of Carter's cross-bred wheats were ready for sale. Messrs Garton of Newton-le-Willows have secured not only crossed wheats, but cross-bred oats and barleys. Their work commenced in 1880, and is still going on. Messrs Garton do not stop at *simple crosses*, but combining many varieties into one, turn out *composite crosses.*

On the Continent also, experiments have been conducted on the crossing of wheat and barley, but not on oats. Rimpau's work, carried out from the purely scientific standpoint, is most remarkable. The results are fully described and figured in 'Landwirthschaftliche Jahrbücher,' 1891.

Sexuality of Plants.

In the days of Aristotle, plants were regarded as destitute of sexuality. Later, some thinking men were of opinion that plants, like animals, might be of two sexes—male and female. To get rid of surmise, it had to be shown by actual experiment that no seed capable of germination could be produced without co-operation of pollen. This proof was first given in 1694 by Camerarius, a professor of botany in Germany. He removed the anthers from the plants under experiment, and thus prevented access of pollen. He found that, under these circumstances, no fertile seed was produced.

About 1740 the results obtained by Camerarius were adequately confirmed by James Logan, Governor of Pennsylvania, who experimented upon Indian corn or maize. In the month of October of that year Logan noted the following results: 1. The cobs from which stamens and pollen had been removed were unfertilised. 2. On the cobs from which some of the stigmas had been removed he found exactly as many grains of corn as he had left stigmas. 3. A young cob wrapped in muslin produced only empty husks.

These results led observers to the new and much more abstruse question, namely, How does the pollen fertilise the ovule and convert it into a seed? Some surmised that a subtle essence evolving from pollen entered the ovule, and set up a process of fermentation therein—a fermentation which resulted in the production of an embryo plant. Others were of opinion that pollen contained immature embryos, and that one of these was planted in the ovule before it became transformed into a seed. As before, experiment had to answer this question, and many years elapsed before the truth was arrived at. The results may be briefly stated thus:—

For seed production the co-operation of male and female is absolutely necessary. Unless fertilising matter from the male enters and impregnates the egg of the female, no seed and no baby plant or embryo can be produced. The pollen grain has accordingly to germinate and form a sire producing fertilising material; the ovule has to produce in its interior a dam with an egg. The suitable germinating bed for pollen is the *stigma* —a special outgrowth of the case which envelops and encloses the ovule. When the pollen grain germinates, it sends down a pipe or *pollen-tube* containing the fertilising matter, or sperm, into the ovule. Sperm from the pollen tube enters into and blends with the egg within the ovule; this blending of fertilising matter with the egg constitutes *fertilisation*. The embryo is the young plant formed from the combined egg and sperm, and the resultant seed is the changed ovule containing dam and embryo.

The flower parts essentially concerned in crossing are:—

Pollen—producing the sire.
Stamen—producing the pollen.

Ovule—producing the dam.
Pistil—protecting the ovule and providing a germinating bed for pollen.

Self-fertilisation of Cereals.

The flower of a cereal plant is composed of a tiny knob, to which are attached—

1. Two excessively minute scales—*lodicules*.
2. Three pollen-making organs—*stamens*.
3. An ovule protector, with a single ovule in its interior—the ovule case or *pistil*.

The germinating bed for the pollen is the pair of feather-like outgrowths from the pistil.

This flower is concealed by and completely enclosed within a husk, composed of:—

1. The valve of the husk below the flower—the *lower pale* or *fertile glume.*
2. The valve of the husk above the flower—the *upper pale.*

The parts specially concerned in grain production are:—

1. *The sire,* derived from the pollen.
2. *The dam,* produced within the ovule.

In the ordinary course of nature both parents are derived not merely from the same plant and from the same ear, but from the self-same flower; for this reason, the cereals are said to be *self-fertilised*—two blended portions from the same flower produce the embryo contained within the grain. If pollen is defective, no sire can be produced; if ovule, no dam: both must play their parts in order to produce the cereal grain. Extraneous pollen can find no entrance, unless by rare accident, because when the flower parts are in *receptive condition* they are completely enclosed within the two-valved husk. Self-impregnation *must* thus be the rule among cereals; it is futile to draw ropes across the field in order to spread the pollen, and with the expectation of increasing thereby the yield of grain. Evidently the best plan is to select a suitable variety, which naturally yields pollen in abundance, for abundant pollen in a cereal means that there is little likelihood of failure to "set" the grain.

After receptive condition has passed, and after the pollen has been sown on the stigma of the flower which bore it, the husk opens, not for the purpose of allowing entrance of extraneous pollen, but rather in order to get rid of the now useless and encumbering anthers. Husk-opening is due to the swelling of the minute flower-scales (lodicules), which are at this time charged with excessive water. As water leaves the flower-scales, downward pressure becomes diminished, and the husk regains its original and closed position.

Whenever self-fertilisation occurs, no extraneous matter has entered and no new character is imparted; as result, the progeny of cereals retain the individuality and repeat the peculiarities imparted by the plant which bore the flower; there is no stimulus to "sport" and "variation"; the course of life glides smoothly on, and the breed is continued pure and practically unchanged. Fixity and want of sportive character confirm the view that the cereals in ordinary cultivation are self-fertilised and not crossed.

Environment, of course, must and does exercise a modifying influence, but as compared with reaction and disturbance set in action by the introduction of pollen from a different variety, such modification is infinitesimally small and readily counteracted, in practice, by "change of seed."

Cross-fertilisation of Cereals.

Cross-fertilisation of cereals, brought about in the ordinary course of nature, is of rare occurrence; artificially, however, crosses have been and can be got in all—in wheat, in barley, and in oat.

To secure the cross, self-fertilisation must be prevented. This is accomplished by removing all the anthers before they open, from the flowers intended to be crossed. Care must be taken that the anthers are not burst by the operation of removal. The pollen to be used is taken from a selected variety with suitable peculiarities—evidently a fundamental requirement is capability of producing abundant and vigorous pollen. The stigma is the receptive part, and the selected pollen is applied when the stigma is in *receptive condition*, or, for certainty, even earlier; application of pollen to a stigma whose receptive stage has passed is mere waste of time, and can yield no result. When the sexual act has been accomplished, an embryo plant is the result—an embryo capable of developing an individual combining characters derived from the varieties used for its production; in after generations, its progeny may even show new points of value possessed by neither parent. When *two* varieties are used the resultant is called a *simple cross;* when three or more varieties are blended by repeated crossing, the resultant is a *composite cross.*

Crossing as applied to cereals is thus a method of almost infinite resource; in the hands of the artful breeder who knows how to combine, how to compound, and how to select, the plants are as clay in the hands of the potter.

The components of a cross are thus designated:—

1. *Pollen-bearer* (erroneously called *male*) — the variety which produced the pollen used for crossing.
2. *Ovule-bearer* (erroneously called *female*)—the variety to which the pollen was applied, and which bears the crossed grain.

The Products of a single Crossed Grain.—The *first product* is a plant often intermediate in character between the components of the cross. This produces self-fertilised grains. The *second generation* is a crop of plants which seems to obey no law—which "sports" and varies in all directions. Some of the progeny show increased, some diminished energy; some show advance and improvement, others deterioration. The grains are again produced by self-fertilisation. From this generation the breeder selects the best single plant for further growth.

The *third generation* is yielded by grain taken from the best plant of the second generation. The crop is still sportive and variable as regards some of the progeny, but in some the reaction

and disturbance may be subsiding. The grains are produced by self-fertilisation. The best and most promising plant is again selected for further growth.

The fourth, fifth, sixth, and successive generations are reared and selected till disturbance completely subsides, and till fixity of character is attained: a new cross-breed is the result. Any variations which still appear after the third generation are usually reversions.

From this course of events it is evident that a commercial breeder can have almost as many new varieties as he chooses.

Plates V. and XII. exemplify the nature of the products derived from crossed grain.

History of Cereal Crossing at Newton-le-Willows.

To properly appreciate the nature of the difficulties connected with cereal crossing, it is advisable to give a short chronological account of the experiments carried on by Messrs Garton at Newton-le-Willows, Lancashire.

1880 to 1883.—Work commenced in 1880, and efforts were made to cross wheats, oats, and barleys, but without result. During these years, the plants were not taken in hand till anthers and stigmas were hanging out between the valves of the husks. At this stage the anthers could yield little if any pollen to the brush used for its collection, because they had already sown their contents. At this stage, too, pollen had already been applied, and the stigmas had passed the receptive stage. Three years of failure taught the experimenters that if cereals were to be crossed, attempts to do so could not be commenced too early in the season.

1884.—Renewed efforts were now made to obtain crosses of all the cereals. Operations were commenced as soon as the anthers were discernible—to see them the husk had, of course, to be opened. Scores of attempts were made from this early stage onwards. The plant selected as ovule-bearer (the so-called female) was treated thus:—the anthers were removed from those flowers to which pollen was intended to be applied; this was done in order to prevent self-fertilisation. The variety selected as pollen-bearer (the so-called male) was treated thus:—the anthers were removed by forceps, and opened by a fine needle. The pollen was applied to the stigma of the ovule-bearer ("female"), thus:—the opened anther was gently moved over the feathery stigma. At this time protection from extraneous pollen and water was considered necessary, and, accordingly, a covering of oiled tissue was put over each flower operated upon: this precaution afterwards turned out to be quite unnecessary.

The result of this year's work was:—

Wheat, several crosses.
Oat, no crosses.
Barley, no crosses.

Some of the wheat crosses were got from closely allied varieties; these yielded grains of normal character. One combination of distinct wheat types may be specially mentioned as exemplifying a somewhat violent cross—namely, between a Rivett type or grey wheat (*Triticum turgidum*) and Hallett's white (*Triticum vulgare*); the resultant grain was somewhat shrivelled in appearance.

The lesson learned from this year's work was that the crossing of oats and barleys required a very high degree of manipulative skill. The difficulty is to open the husk and remove the anthers without injuring the ovary.

1885.—The *first products* of the various crossed wheats were now secured. The progeny were quite like the variety selected as ovule-bearer (the "female"). The product of Rivett × Hallett resembled neither parent, but was of intermediate character with some new features.

The experimenters, having gained dexterity in crossing, took oats and barley again in hand, this time with success, and among several crosses secured—

Black Tartarian × White Canadian oat.
Chevalier × Golden melon barley.

The crossed grains of oat and barley were perfectly normal in appearance.

It was now apparent that protection of the crossed flowers by oiled tissue was superfluous, so its use was given up.

1886.—The *second generation of the crossed wheats* was now secured. No two roots produced identical ears, but all the heads borne by the same plant were exactly alike. Some of the types obtained were not intermediate, but quite new. Some were remarkably fertile with abnormally large grains; others were more or less sterile.

At this time wheats were obtained from various foreign countries—from India, South America, &c.

The *first product of the crossed oats*—*e.g.*, Canadian × Tartarian —yielded an intermediate form with vigorous vegetative organs and abundance of seed. Fresh blood was wanted for further crossing of oat, and foreign types were now obtained—*e.g.*, naked oats (Plate VIII.) from China, others from France, Germany, Italy, &c.

The *first product of the crossed barleys* were vigorous plants with normal seeds. Additional barleys now obtained for experiment were—Fan, Italian, Nepaul, Naked, &c.

1887.—The *third generation of wheat* was sportive in some

cases, but very constant in others. Those forms with largest grains departed most from the second generation, and were rather sportive; those with normal grains were more steady. Some types of these new wheat breeds are evidently beginning to become fixed. That single plant of a generation which was judged best was selected for further operation; indeed, selection *of the best* must be continued year after year till constant progeny is secured. Maximum improvement must not be sacrificed for the sake of rapid fixing.

The *second generation of oats* was much more sportive than the barleys of the same generation. Some types were more or less sterile, with long thin grains; others produced grains about twice as large as those of the parents used to make the cross, and so forth.

The *second generation of barleys* was somewhat sportive with intermediate types. Here and there in the sterile rows of spikelets grains were produced. In some instances, all the sterile rows became fertile, and the two-rowed became a six-rowed barley. This holds good even though both parents are two-rowed. These extra grains were, however, very minute—scarcely larger than a seed of Timothy grass.

The experimenters could now cross wheat varieties, oat varieties, and barley varieties to a certainty; and, looking at the different types already evolved and in course of evolution, they were quite naturally led to make second crosses upon the cereals, in order to incorporate other desirable characters—that is, to combine in a single individual the peculiarities possessed by three or more varieties. Repeated crosses obtained by the use of more than two parent varieties are called *composite crosses*, to distinguish from *simple crosses* produced from two varieties only. As example, a composite breed of oat (Plate X.) may be mentioned. Three varieties have been used in its formation:—

1. White Canadian oat.
2. Black Tartarian oat.
3. Naked oat.

About this time the experimenters were evidently deeply impressed with the difficulties in the way of crossing *ordinary* varieties of oat and barley. Accordingly they sought out other kinds of easier manipulation, and in naked oats and naked barleys found what answered their purposes; from these, as from wheat, the grains are easily threshed out, which means that the pales are most readily opened, that access to the enclosed flower is readily obtained, that crossing is correspondingly easy. Difficulties now vanished, and crossed oats and crossed barleys were as easy to secure as crossed wheats.

1888.—The *fourth generation of wheat.* Some of the progeny were now constant, but others were still variable and unfixed.

The *third generation of oat* was still sportive. The grain from the composite cross with naked oat has yielded its first product.

The *third generation of barley* was somewhat sportive. The minute barley grains produced in the sterile rows (1887) were of low germinating power; some, however, grew up as ordinary two-rowed barleys.

1889 to 1893.—These years were spent in compounding, selecting, and fixing the various breeds, some of which have been in process of evolution since 1884. The composite cross of oat (1888) has yielded—

1. Varieties with naked grains.
2. Varieties with husked grains.

Spikelets from these varieties are shown on Plate XI. The work has now become so extensive, and the improved and improving varieties so numerous, that private enterprise can no longer do justice to the breeds.

A stock of crossed wheat grain, the produce of two acres, is now on hand. Crossed oats and barleys have also been fixed, but as yet they have not been produced in quantity. Last autumn (1893) about 1000 crossed varieties were sown; these included wheats, winter barleys, and winter oats. Almost as many crossed varieties of barleys and oats are intended to be sown during the present spring (1894). Plates VI., IX., and XIII. show some of the results.

Method of Crossing the Cereals.

The method of artificial crossing may be summarised thus:—

First operation, *Stamen removal*, erroneously called *Castration*. The object is to prevent self-fertilisation. Open the husk and remove the *unopened* anthers by means of fine forceps. If the anthers are opened or burst during removal, the object of the operation is defeated, accordingly the stalk which bears the anther, and not the anther itself, is gripped by the forceps. Special care must be taken that the ovary is not injured during "castration." The subject selected for this operation is the ovule-bearing parent (the "female"), and from three to six of its flowers may be "castrated."

Second operation, *Pollination*. A suitable pollen-bearer (the "male") is selected. From this an unopened anther is removed and burst by a gentle squeeze of the forceps. Pollen is applied to the stigma of the ovule-bearer (the "female") in either of two ways:—

1. By gently moving the burst anther over and in contact with the stigma.
2. In the case of wheat, by pressing the burst anther against

the inner surface of the lower pale of the husk. The pale when it closes brings the pollen into contact with the stigma.

This operation must be performed either before the stigma is in receptive condition, or when it has reached this condition, but not later.

If both operations have been properly carried out the cross is assured; nothing more is necessary.

Wheat is easily crossed, because the parts of the young plant are somewhat rigid, and because "castration" is easily performed without injuring the ovary.

Oat is not easily crossed, because it is difficult to "castrate" without injuring the ovary; the ovary of the naked oat is less liable to injury. Pollination is also difficult, because the amount of pollen in an anther of oat is very scant.

Barley is difficult to "castrate" without injuring the ovary; naked barley is, of course, more easy. Pollination is not difficult, because the anther contains abundant pollen. The stigma is in *receptive condition* at a very early period—before the ear has completely emerged from the sheath.

Fertility of Crosses and Hybrids.—The efficiency of pollen for fertilisation depends upon the closeness of affinity between the pollen-bearer ("the male") and the ovule-bearer ("the female"). Crossed *varieties*, for example, yield progeny with fertile seeds, whereas crossed species or genera (*hybrids*) yield sterile progeny with infertile seeds. Among wheats, crosses with *Triticum monococcum* and *T. polonicum* yield sterile offspring, whereas the other types cross freely and produce fertile progeny. *Triticum spelta, dicoccum, vulgare,* and *turgidum* may, accordingly, be regarded as varieties of one species—namely, *Triticum sativum* (L.). From this point of view there are three species of wheat:—

Species I. *Triticum monococcum.*
" II. *Triticum polonicum.*
" III. *Triticum sativum.*

All the types of cultivated oat, when crossed, yield fertile species, and the same applies to barley. The various types of oat thus constitute one species, and the various barleys also belong to one species.

Varieties of Cereals experimented upon at Newton-le-Willows.

Wheat.—Over 350 wheats from all parts of the world have been examined and tested at Newton-le-Willows. These include—

English, 36 varieties—*e.g.*, Hardcastle White, Talavera, Hunter's White, Lammas, Sheriff's Squarehead, Rivett, &c.

German, 25 varieties—*e.g.*, Weiss Kolben (a white beardless variety), Probsteier, Bartweizen (a bearded variety), &c.

French, 26 varieties—*e.g.*, Nöe, Victoria (summer), Victoria (winter), &c.

Russian, 4 varieties—*e.g.*, Taganrog, Kubanka, Galitz, &c. Taganrog has proved most useful for raising new breeds.

Hungarian, 15 varieties, principally soft—*e.g.*, Frankensteiner, Banater, Hungarian Mountain, &c.

Grecian, 104 varieties, principally hard wheats.

Italian, 25 varieties, very similar to the Grecian.

Indian, 60 varieties, principally hard wheats, very early, very short in the straw, and very liable to rust.

Australian, 12 varieties—*e.g.*, Port Victor, Blount's Fife, Australian Summer, &c.

Japan, 2 varieties of soft wheat, very similar to the Indian, but producing more straw.

North American, 45 varieties—*e.g.*, Armstrong, Fultz, Early Red Clawson, Michigan Bronze, Martin's Amber, &c. These are principally acclimatised Russian varieties.

Wheat Types.—The wheats under cultivation are reducible to seven types:—

Type I. *Triticum monococcum* (L.). The spikelet produces one grain; the lower pale splits when ripe.

Type II. *Triticum spelta* (L.)—Spelt. Ear loose and four-sided; grains do not fall out in threshing; glumes truncate at the apex with a blunt median tooth.

Type III. *Triticum dicoccum* (Schr.). Ear dense and two-sided; grains do not fall out in threshing; glumes tapered to the apex with a sharp median tooth.

Type IV. *Triticum vulgare* (Vill.)—Common Wheat varieties. Ear compact; grains threshed out; glumes very blunt, keeled only towards the apex.

Type V. *Triticum turgidum* (L.). Ear compact; grains threshed out; glumes keeled along the whole length; grain short, thick, and blunt. Taganrog and Rivett are varieties of this type.

Type VI. *Triticum durum* (Desf.)—Hard Wheat. Ear with remarkably long awns; grains threshed out; glumes keeled along the whole length; grain elongated, narrow, flinty.

Type VII. *Triticum polonicum* (L.). Glumes very large, elongated and papery; grain elongated and narrow.

Oat.—About 100 varieties of oat have been tested. These include—

British, 20 varieties—*e.g.*, Scotch Potato, White Canadian, Black Tartarian, Yellow Poland, Winter Tawny, &c.

German, 12 varieties—*e.g.*, August White, August Yellow,

Thuringer, a very vigorous but very late variety, Rugenscher, &c.

French, 10 varieties—*e.g.*, Houdan, very productive of small grains, and used to increase the number of grains in ordinary varieties; Etampes, remarkably early, used in combination with Black Tartarian to secure earliness and to increase size of grain; Flanders Yellow, &c.

Russian, 7 varieties, but none of value.

Hungarian, 6 varieties, very like our own.

Grecian, 6 varieties, very similar to the Italian.

Italian, 8 varieties—*e.g.*, White Sicilian, Maremmam, Turkish (similar to our Potato Oat).

Indian, 12 varieties, not worth cultivating.

Australian, 6 varieties, like our own.

North American, 14 varieties, very like our own.

Oat types.—The oats in cultivation can be reduced to three types:—

Type I. *Avena sativa* (L.)—Common Oat. Ear a panicle with branches spread round the central axis; grains do not fall out in threshing.

Type II. *Avena orientalis* (Schroeb.)—Tartarian Oat. Ear a panicle with branches confined to one side of the axis; grains do not fall out in threshing.

Type III. *Avena nuda* (L.)—Chinese or Naked Oat (Plate VIII.) Axis of spikelet elongated; grains fall out in threshing; spikelet very prolific.

Barley.—Over 70 varieties of barley have been tested. These include—

British, 10 varieties—*e.g.*, Bere, Two-rowed, &c.

German, 14 varieties—*e.g.*, Erfurter White, Kaiser, Edel (naked), &c.

French, 4 varieties—*e.g.*, D'Italie, Coeleste, &c.

Hungarian, 4 varieties—*e.g.*, Hanna, Oregon, &c.

Grecian, 10 varieties, chiefly six-rowed.

Indian, 12 varieties, not worth cultivating.

Australian, 2 varieties—Australian White and Victoria, both two-rowed.

Japanese, 3 varieties, all naked.

United States, 4 varieties—Imperial, Vermont Champion, Two-rowed Naked, Duckbill or Fan.

Several of the most useful varieties are described in connection with the plates.

Barley types.—Cultivated barleys are reducible to three types:—

Type I. *Hordeum hexastichon* (L.)—Six-rowed Barley. All the spikelets fertile, and arranged in six rows, the lower spreading.

Type II. *Hordeum vulgare* (L.), (Plate XIII.)—Four-rowed or Square Barley. All the spikelets fertile, but arranged in four rows. Bere is a well-known representative of this type.

Type III. *Hordeum distichum* (L.), (Plate XIII.)—Two-rowed Barley. Two opposite rows of spikelets alone fertile. Chevalier barley is a well-known variety of this type.

Objects and Results of Cereal Crossing at Newton-le-Willows.

The object of raising new breeds is not only to combine in the new the valuable characteristics possessed by two or more varieties, but to evolve and to add new properties.

The objects which must be kept steadily in view by the breeder are:—

1. Increased size, improved quality, and earliness of grain.
2. Increased number of grains per ear.
3. Production of strong and abundant straw.
4. Production of a hardy plant with strong and vigorous constitution.

Wheat.—A wheat, for example, should produce abundant grain, which ripens early, is of large size, and of good quality; should tiller freely, and produce abundance of strong straw, with no tendency to become top-heavy and to lodge. By crossing red and white wheats, the colour of white may be obtained, with the strength and body of red. The introduction of Spelt and of Turgid types (Rivett wheats) leads to greater agricultural perfection of the vegetative organs, and also improves the quality of the grain.

The Spelts are used for two special purposes:—

1. To prevent loss from "shaking," by fixing the grain more firmly in the husk.
2. To improve the milling quality of the grain.

Plate V. shows a combination of various red and white wheats with Spelt. Plate VI. shows a combination of various red and white wheats with a Turgid type (Paine's Defiance) yielding extra large grain. Plate VII. shows how the number of grains per spikelet or breast becomes increased by crossing.

Oat.—In the case of oat, the size of the grain may be almost doubled, the yield per ear largely increased, the straw made stronger and more abundant, and the whole plant more hardy. Plate VIII. shows two varieties of Naked oat (*Avena nuda*) used for increasing the yield per ear. Plate IX. shows a combination of ordinary varieties with White Tartarian and Naked oat; the ear figured gives a largely increased yield of grain, not husked, however, but naked as in the *Avena nuda* parent—a great drawback. Plate X. shows a combination of

ordinary varieties with Black Tartarian and Naked oat: the grain is again naked and not husked. Plate XI. shows how the number of grains per spikelet becomes increased by the use of Naked oat: all the spikelets here figured yield naked grains except the three at the bottom. The rule is this:—when more than four grains are produced by a spikelet, all are naked.

Varieties of Winter oat crossed with the best Tartarian forms yield hardy breeds, capable of standing the winter, and equal to the best spring varieties in quantity and quality of grain.

Barley.—A barley with prolific ear, with large grains of good quality, at the same time hardy and early, is desirable. A form like bere, with none of the spikelets sterile, with lengthened ear, and producing large grains of good quality, can be raised by judicious crossing of two-rowed with six-rowed barleys of the bere type (Plate XIII.). Naked barleys can be freely compounded with husked forms, because the tendency of the compound is to produce husked grains; in oat, the tendency is in an opposite direction, the introduction of a naked parent leading to the production of naked grains by the compound cross.

To raise a good breed of hardy winter barley has been one of the chief objects of Messrs Garton's work in connection with this group of cereals. They find that it is much more easy to secure hardy crosses of winter barleys than of winter oats. Taking bere as the hardy winter form, crossing with the best two-rowed spring types, sowing the produce always in autumn, and breeding from the survivors, they ultimately secure a winter barley hardier than winter wheat. The grains show great energy and rapidity of germination; adverse conditions, however extreme, can scarcely impede the growth. In some districts this breed could be used as early feed for sheep without injury to the after grain crop. The grains are of very fair malting quality, and ripen early; last year, for example, this new type was ripening whilst spring barley was quite green.

Plate XII. shows some of the varieties got by compounding two-rowed, six-rowed, naked and husked, bearded and beardless, barleys.

Plate XIII. shows one of the six-rowed and one of the two-rowed parents. The ear in the centre shows the breed raised by the combination.

Weight increase of a single grain.—The following table may serve to give an idea of the amount of increase in size and weight of the grains compared singly, as obtained by Messrs Garton:—

	Percentage of increase by weight, per grain.
Wheat	50 (as compared with Hardcastle White, Plate VI.)
Oat	60 (as compared with Black Tartarian).
Barley	20 (as compared with the best Two-rowed Barleys)

This table shows that barleys are capable of least improvement in size and weight of grain, whereas oats can be very considerably increased. To the agriculturist, increased size of grain means—

1. Vigorous germination and vigorous plant.
2. Increased crop.
3. More complete utilisation of the soil.

Pollen increase in Cross-breeds.—It is too often forgotten that if pollen is impotent and cannot germinate, grain is not produced, and empty husks result. The cross-breeder is forced to take pollen into account, and to select for his purposes anthers well filled with vigorous pollen. The breeds raised by crossing are then, as a rule, good pollen-makers, with less than ordinary tendency to produce empty husks.

In judging any cereal breed, pollen ought, therefore, always to be considered.

Other Experiments on Crossing.

Maund's and Raynbird's Experiments.—In the London exhibition of 1851 there were two exhibits of crossed wheats, one by Mr Maund of Worcester and another by Mr Hugh Raynbird of Basingstoke. The jury on these exhibits included two world-renowned botanists—Sir Joseph Hooker and John Lindley. Lindley says that the wheats exhibited were undoubtedly crossed, and no one can question his decision. Part of the exhibit was a set of anomalous and sportive forms which showed that crossing had actually taken place.

One of the crosses exhibited was Hopetoun × Piper's Thickset. In 1846 the Thickset was grown in a garden, and inoculated with pollen from Hopetoun. The produce—a few shrivelled grains—was planted early in autumn of the same year. From these grains a great variety of wheats was ultimately secured, some red, and some white; some like Piper's Thickset; others like Hopetoun in everything except the chaff; still others with part of the ear thin and open and the remainder of the ear closely set. This description adequately confirms Lindley's dictum that the wheats were truly crossed.

Carter's Cross-bred Wheats.—A full account of Carter's work in connection with raising cross-bred wheats is given in the Journals of the Royal Agricultural Society of England. The

following are some of these crossed wheats that have been put upon the market:—

1. Red Wheat crossed with White Wheat.
2. Red Wheat crossed with Amber Wheat.
3. Red Wheat crossed with Bearded White Wheat.
4. Velvet-chaff White crossed with Club-headed Smooth Chaff.
5. White Wheat crossed with Bearded Amber Wheat.
6. Amber Wheat crossed with Red Wheat.
7. Square-headed Smooth Chaff crossed with Bearded Amber.
8. Velvet-chaffed Square-headed White crossed with Red Square-headed.
9. Bearded Red crossed with Bearded Amber.
10. Velvet-chaffed White crossed with Bearded Amber.

Rimpau's Experiments.—A full account of these experiments was published in 1883 ('Landwirthschaftlicher Kalender,' von Mentzel und von Lengerke, part ii.) The object was to find out the changes produced in the form of cereals and other cultivated plants by means of artificial crossing. The parents used and the crossed produce are figured in 'Landwirthschaftliche Jahrbücher,' vol. xx., 1891. The experiments were carried out partly in pots and partly in a small experimental field. The wheats crossed were—

1. Sächsischer rother Landweizen × Kessingland.
2. Rother deutscher Grannenweizen × Kessingland.
3. Rivett's Bearded × Sächsischer rother Landweizen.
4. Rivett's Bearded × Rother deutscher Grannenweizen.
5. Weisser Kolbenspelz × Rother deutscher Grannenweizen.
6. Rivett's Bearded × Squarehead.
7. Early Red American × Squarehead.
8. Mainstay × Squarehead.
9. Early Red American × Mainstay.
10. Sächsischer rother Landweizen × Squarehead.

The barleys artificially crossed were—

1. Steudel's (two-rowed black) × Gabelgerste (four-rowed, naked, and awnless barley).
2. Pfauengerste (two-rowed naked) × Gabelgerste.

No experiments were made on the artificial crossing of oats.

DESCRIPTION OF PLATES.

PLATE I.

The spikelets, except those at apex, have assumed an extended form of growth, each becoming a miniature ear carrying four or five spikelets; the spikelet produces two or three small grains.

The parents used to produce the composite type were—Black Spelt, Pedigree White, Hungarian Red, Essex Red, Hunter's White, and Talavera. The rotation of crossing was—

A. Black Spelt on Pedigree White.
B. Progeny of A on Hungarian Red.
C. Essex Red on Hunter's White.
D. Progeny of C on Talavera.
E. Progeny of B on progeny of D.
F. Progeny of C on progeny of A.
G. Progeny of F on progeny of E.

A grain from G yielded, in the third year of growth, the ear here figured.

As in the Spelt type, the grain adheres firmly to the husk, and the axis of the ear breaks up into joints each carrying a spikelet.

PLATE II.

In this case two ears have been combined into one.

PLATE III.

The ear of ordinary barley is simple, whereas the monster here figured is branched, combining many ears in one. The branching habit of growth is almost hidden by the dense mass of long beards or awns. The parents which produced this monstrosity were—Fan, Manschurian, Jewel, Golden Melon, and Fruhlings barleys. The rotation of crossing was—

A. Fan on Manschurian.
B. Progeny of A on Jewel.
C. Golden Melon on Fruhlings.
D. Progeny of B on progeny of C.

A grain from D yielded this monstrosity in the second year of growth.

Fan barley is strong in the straw, matures early, and produces inferior grains; strength of straw and early maturity are its special features.

Manschurian is six-rowed, strong in the straw, ripens late, and produces medium quality grains unequally matured; among six-rowed barleys its special features are strong straw and good quality of grain.

Jewel is two-rowed, very weak in the straw, ripens moderately early, and produces excellent grain; quality of grain is its special feature.

Golden Melon is two-rowed, weak in the straw, ripens moderately early, and produces grain of good quality.

Fruhlings barley is six-rowed, strong in the straw, ripens late, and produces very small grains of an inferior quality, evenly matured and very compact; evenness of sample and strength of straw are the special features.

Plate I.—Abnormal ear of Wheat, 5-8ths natural size.

Plate II.—Abnormal ear of Wheat, 9-10ths natural size.

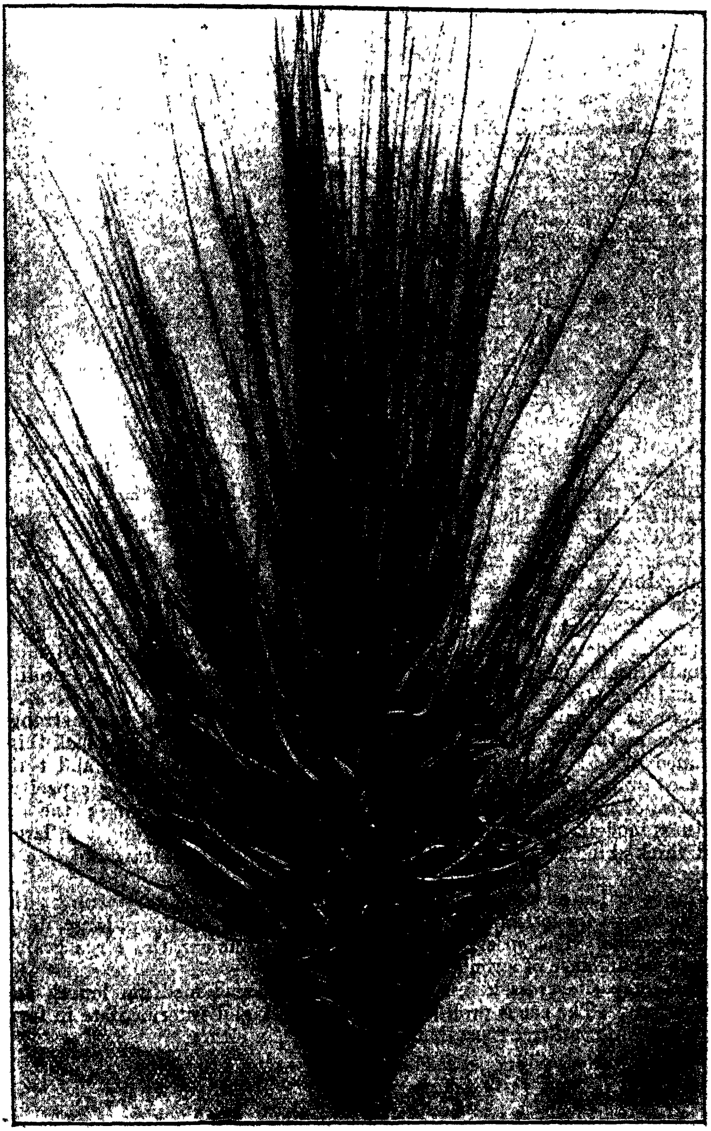


Plate III.—Abnormal ear of Barley, natural size.

PLATE IV.

This abnormality is of the same nature as that shown by Plate III. The upper part of the ear is open and one-sided like Tartarian oat, whereas the base is composed of a dense cluster of branches, each of which resembles a miniature ear of Tartarian. The parents of this form were—Black Tartarian, White Canadian, Scotch Potato, Etampes, Rugenscher, and Thuringer oats. The rotation of crossing was—

A. Black Tartarian on White Canadian.
B. Scotch Potato on Black Tartarian.
C. Etampes on Rugenscher.
D. Thuringer on White Canadian.
E. Progeny of A on progeny of C.
F. Progeny of B on progeny of D.
G. Progeny of F on progeny of E.

A grain from G yielded, in the third year of growth, the ear figured in the plate.

Black Tartarian has a compact one-sided ear; the straw is of moderate length and strong; the grain is elongated, black, and matures moderately late. The special feature is the prolific ear.

Canadian has an open ear; the straw is of moderate length and very weak; the grain matures early, is plump and white with thick skin. The special feature is earliness.

Scotch Potato has an open ear; the straw is long and abundant; grain matures moderately late, is smaller in size, thinner in skin, and more abundant than that from White Canadian. The special features are prolific ear and long straw.

Etampes has an open ear; the straw is very short and very strong; the ear matures very early, and produces a large number of black thin-skinned grains. The special features are earliness, prolific ear, and thin-skinned grain. The pollen is abundant and of high germinating capacity.

Rugenscher has an open ear; the straw is long and strong; the ear matures moderately early, and produces grains which are elongated, large, and thick-skinned. The special features are length of straw and size of grain.

Thuringer has an open ear; the straw is very long and very strong; the ear matures very late, and produces a large number of long, large, deep-yellow grains. The special features are the prolific ear, the large grains, and the abundance of strong straw.

The composite cross here figured has the straw of medium length and very strong. The ear is prolific, the grain black and intermediate in form between Tartarian and Canadian, but larger than either.

Plate IV.—Abnormal ear of Oat, one-half natural size.

PLATE V.

The parents used for raising the types here figured were—Hardcastle White, Black Spelt, Hungarian Red, White Chidham, Pedigree Red, Hungarian White. The rotation of crossing was—

A. Hardcastle White on Black Spelt.
B. Hungarian Red on White Chidham.
C. Progeny of A on Pedigree Red.
D. Hungarian White on Mainstay.
E. Progeny of D on progeny of A.
F. Progeny of B on progeny of C.
G. Progeny of F on progeny of E.

A single grain from G produced, in the third year of growth, the six types figured on the plate.

Hardcastle White.—Straw medium long and weak; ear unbearded; chaff white; grain white, and of good quality.

Black Spelt.—Ear bearded and brittle; chaff adherent; grain remarkably rich in gluten.

Hungarian Red.—Straw of medium length and very strong; ear unbearded, very short, and compact; chaff red; grain like dark amber, matured late. The special features are hardihood and strength of straw.

White Chidham.—Straw thin and weak; ear unbearded, short, and thin, moderately prolific; chaff white; grain white, of good quality, and matured early. The special features are earliness and grain quality.

Pedigree Red.—Straw of moderate length and weak; ear unbearded; chaff white; grain large like dark amber, matured late. The special features are hardihood, vigour, and large size of grain.

Hungarian White.—Ear bearded; chaff white; grain white, of good quality, and matured early.

Mainstay.—Straw of medium length and strong; ear unbearded, very prolific; chaff white and rough; grain white, matured late. The special features are the strong straw and the prolific ears.

Type *a.*—Ear bearded (like Spelt and Hungarian White), shaped like Pedigree Red, but more heavily set; chaff adherent and black as in Spelt.

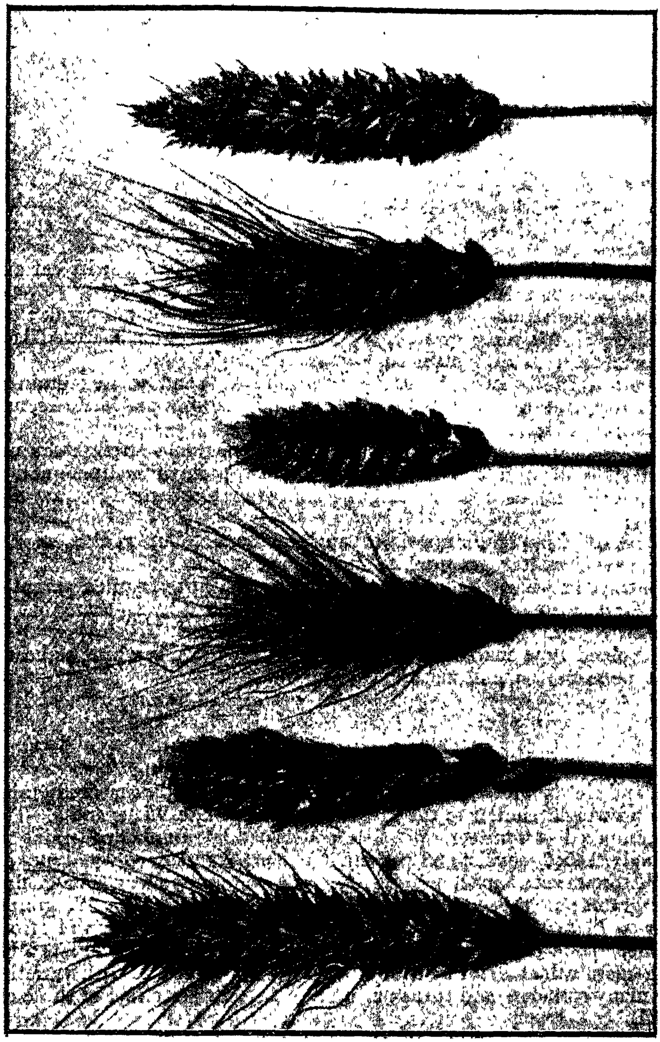
Type *b.*—Ear abnormally congested, especially towards apex; chaff woolly like Mainstay, strong and with a tinge of dark colour derived from the Spelt parent.

Type *c.*—Ear bearded like Spelt and Hungarian White, shaped like Hungarian Red; chaff dark amber-coloured. This ear is the shortest on the Plate—its length is 2½ inches, and it counts eleven spikelets in a row. Another ear from the same parents, also counting eleven breasts, measured 9 inches in length.

Type *d.*—Ear very compact as in Hungarian Red; chaff like dark amber, and strong in texture like Spelt.

Type *e.*—Ear abnormally congested as in type *b*, but bearded; chaff black and strong as in Spelt.

Type *f.*—Ear like Hungarian Red, but longer, showing influence of the long-eared parent; chaff like dark amber.



a b c d e f

Plate V.—Six types of Wheat from a composite cross, one-half natural size.

PLATE VI.

The parents used for the production of the evolved types, figured on the plate, were—Paine's Defiance, Hardcastle White, Victoria d'Automne, Talavera, Squarehead, Pedigree White. The rotation of crossing was—

A. Paine's Defiance on Hardcastle White.
B. Victoria d'Automne on Talavera.
C. Squarehead on Pedigree White.
D. Progeny of B on progeny of A.
E. Progency of C on progeny of D.

Paine's Defiance is a variety of Rivett wheat (*Triticum turgidum*). The straw is very long and strong; ear elongated, well set, heavily bearded, and very prolific; grain of inferior quality, and matured late. The special features are—the long and strong straw, the prolific ear.

Hardcastle White was described in connection with Plate V.; its ear and three grains are figured.

Victoria d'Automne.—The straw is of moderate length, but weak; ear unbearded; chaff white; grain large, of dark-amber colour, matured late. The special features are hardihood, vigour, and large grain.

Talavera.—The straw is weak; ear unbearded; chaff white; grain of good quality, matured very early. The special features are earliness, and good quality of grain.

Squarehead.—The straw is of medium length and very strong; ear unbearded, short, compact, and prolific; chaff white; grain of medium quality, dark coloured, matured late. The special features are strong straw and prolific ear.

Pedigree White.—The straw is of medium length, but weak; ear unbearded; chaff white; grain white and of good quality.

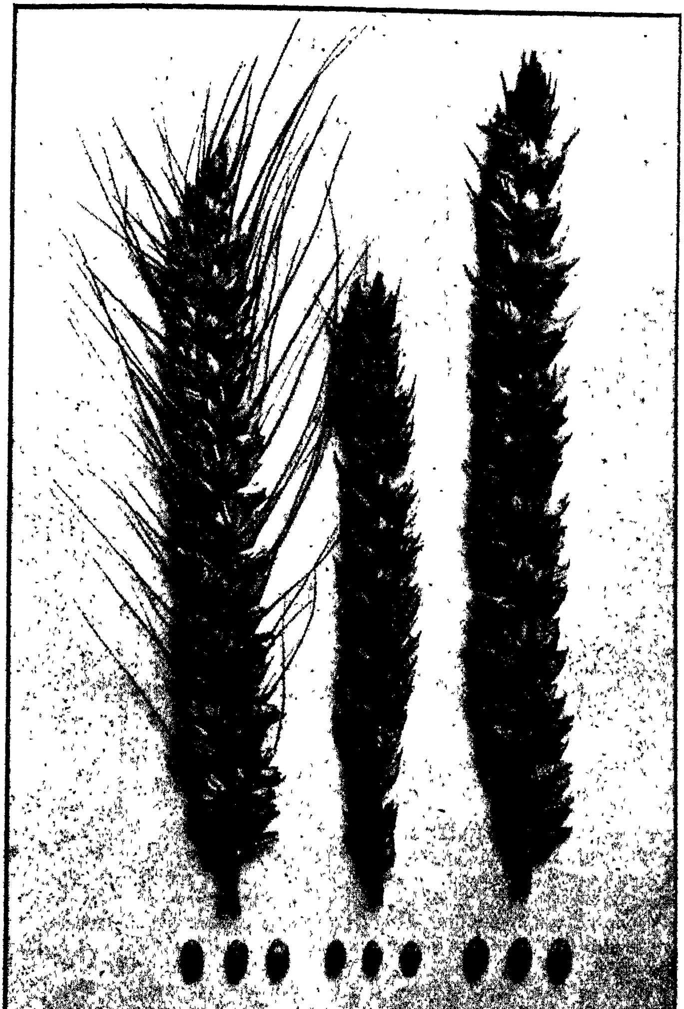
The evolved type, marked *a*, shows the influence of the bearded parent—*Paine's Defiance;* the grain is red, and 50 per cent heavier than that of *Hardcastle White.*

The evolved type marked *b* is unbearded; the grain is white, as heavy as the type marked *a*, and matures early.

PLATE VII.

Each spikelet or breast produces seven or eight perfectly matured grains of size and weight similar to the grains figured on Plate VI., *a* and *b*. The ear is composed of fourteen spikelets, and the total number of grains is, accordingly, 14×7, equal to 98 per ear. The ears of the evolved types on Plate VI. produce twenty-four spikelets, each containing on an average five mature grains; in this case the total grains per ear is $24 \times 5 = 120$ grains. The ear on Plate VI. is thus more valuable than that on Plate VII., from the farmer's point of view; to the breeder, however, the form on Plate VII. is much more valuable, for he uses it as a parent, crosses it with varieties having many spikelets, and turns out a breed better than either of those on Plate VI.

By combining, for example, an ear bearing twenty-four spikelets (Plate VI.) with this type (Plate VII.), the breeder produces an ear bearing 24×7 grains $= 168$ grains per ear.



a Hardcastle White. *b*

Plate VI.—A parent variety and two evolved types of Wheat, one-half natural size.

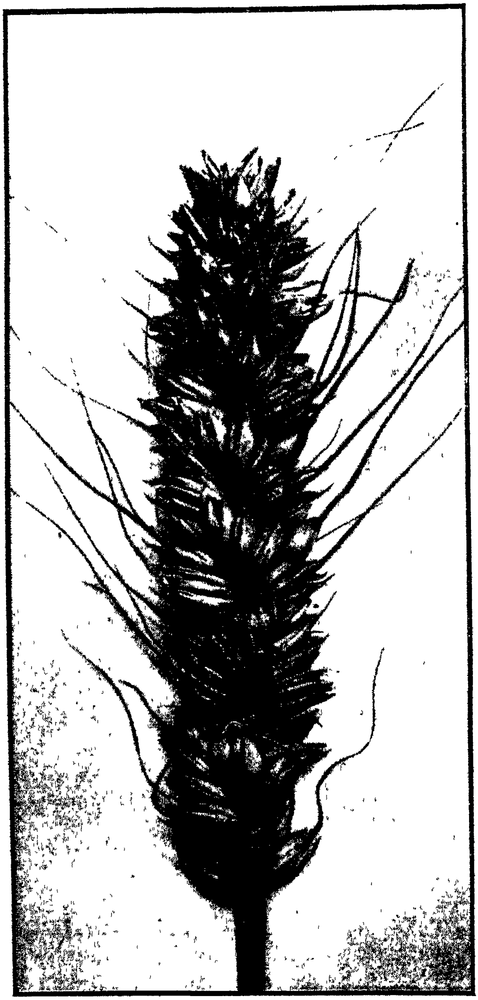


Plate VII.—Wheat ear showing increased number of grains per spikelet, natural size.

PLATE VIII.

The two varieties of Naked oat (*Avena nuda*) shown on this plate have been used as parents in raising composite breeds of oats. Both produce naked grains—that is to say, there is no adhesion between husk and grain; in this respect Naked oat resembles wheat and differs from ordinary oat.

A detached spikelet of each variety is figured—one to the right and another to the left—near the base of the ears. Instead of producing merely one or two grains like ordinary oat varieties, the spikelet of Naked oat lengthens its axis and produces four or five grains.

Variety *a.*—Ear one-sided like Tartarian; grain very minute; straw thin, but very fibrous and strong.

Variety *b.*—Ear open and branched; grain larger; straw weak.

PLATE IX.

The parents used for raising this breed were—Naked oat (Plate VIII. *b*), Waterloo, White Tartarian, Scotch Potato, Thuringer, White Canadian, and Rugenscher.

Naked Oat, b.—Described in connection with Plate VIII.

White Tartarian.—Ear compact, one-sided, and late; grain slender, of inferior quality; straw strong, of medium length.

Waterloo.—Ear open, prolific, and medium early; grain long and white; straw weak. Productiveness is the special feature.

The other parents are described in connection with Plate IV.

The evolved type has an ear intermediate in form between White Tartarian and the open-headed parents. The influence of Naked oat on the shape and nature of the spikelets is most pronounced; like this parent the evolved type produces elongated spikelets composed of many naked grains. A detached spikelet is shown to the left of the ear, near the top of the plate.

PLATE X.

The parents used for the production of this type were—Naked oat (Plate VIII. *b*), Black Tartarian, White Canadian, Scotch Potato, and Etampes. These parents have been described in connection with other plates.

In the evolved type, the form of ear is evidently derived from Black Tartarian. The detached spikelet to the left is constructed like that of Naked oat; it is elongated, produces many naked grains, and bears white chaff. As in Plate IX., so here the nature of the spikelet is chiefly determined by the Naked oat parent.

PLATE XI.

All the forms of spikelets or breasts here figured have resulted from crosses between Naked oat (Plate VIII.) and varieties in ordinary cultivation. Some of the types produced in this way have now become stable and fixed, but many of the most valuable have resisted all attempts at fixing. When specially enlarged and elongated spikelets are produced the tendency to produce naked grains is very strong. The three spikelets at the bottom of this plate yield husked grains like ordinary oats. The other six spikelets figured are remarkably prolific, but the grains are naked, not husked. The two spikelets to the left of the bottom row are taken from fixed and constant varieties.

It is evident that the yield of oat may be largely increased, but the limit is soon reached because of the tendency of the most productive forms to yield naked grains.

a b

Plate VIII.—Two varieties of Naked Oat, 4-5ths natural size.

Plate IX.—Evolved type of Oat, one-third natural size.

Plate X.—Evolved type of Oat, one-half natural size.

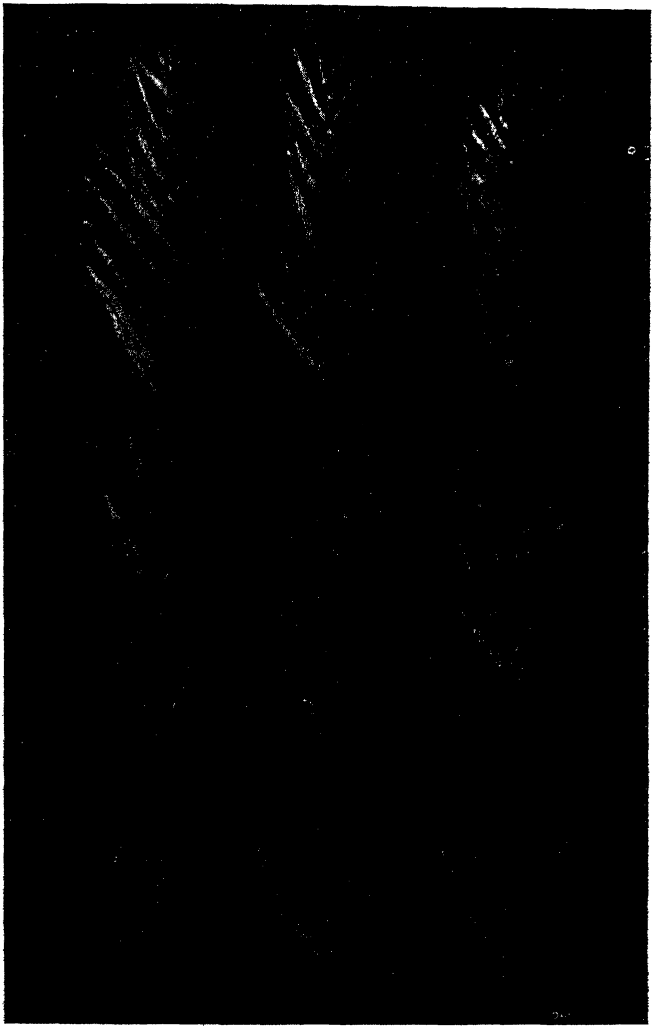


Plate XI.—Nine Oat spikelets from evolved types, 5-6ths natural size.

PLATE XII.

The parents used were—Fan, Fruhlings, Golden Melon, Manschurian, Chevalier, Nepaul, and Italian barleys. The first four parents are described in connection with Plate III.

Chevalier (see Plate XIII.)—Straw very weak; ear two-rowed, very long and drooping; grain of good quality.

Nepaul.—Ear six-rowed, entirely destitute of beards; grain naked. Absence of beard is the special feature.

Italian.—Straw long and strong; ear two-rowed, compact, and erect; grain of inferior quality. Straw and form of ear are the special features.

Type *a.*—Ear beardless and six-rowed like Nepaul, intermediate in length between Chevalier and Italian; grain naked like Nepaul.

Type *b.*—Ear bearded and six-rowed like Fruhlings, in length more like Italian than Fruhlings.

Type *c.*—Ear two-rowed and bearded, very similar to the Fan parent, but the beards are erect, and not spreading as in *e* and *i.*

Type *d.*—Ear six-rowed, bearded, very similar to Manschurian, but elongated like Chevalier.

Type *e.*—Ear two-rowed like Italian, but slightly longer, with spreading beards like Fan.

Type *f.*—Ear six-rowed and unbearded like Nepaul; grain husked, not naked as in Nepaul.

Type *g.*—Ear six-rowed like Fruhlings, but longer, and with upright beards.

Type *h.*—Ear two-rowed, very like Chevalier.

Type *i.*—This is a transition form between two-rowed and six-rowed barleys, inasmuch as the spikelets—which are barren in two-rowed types—here produce excessively minute grains.

PLATE XIII.

The parents here figured are *Edel* to the left and *Chevalier* to the right of the plate. The parents used for raising the evolved type here figured were: Edel (a variety of bere), Chevalier, Manschurian, Golden Melon, Jewel, and Italian.

Edel barley, to the left on the plate, is a German variety of bere. The straw is weak; the ear is six-rowed, bearded, elongated, prolific, and matures early; the grain is very small, of poor quality, and of irregular size. The special features are earliness and productiveness. The other varieties used as parents are described in connection with Plates III. and XII.

The evolved type shows the following characters: ear elongated like Chevalier, six-rowed as in Manschurian and Edel, beards partially dropping off at maturity as in Jewel, grain large and of good quality as in the two-rowed parents.

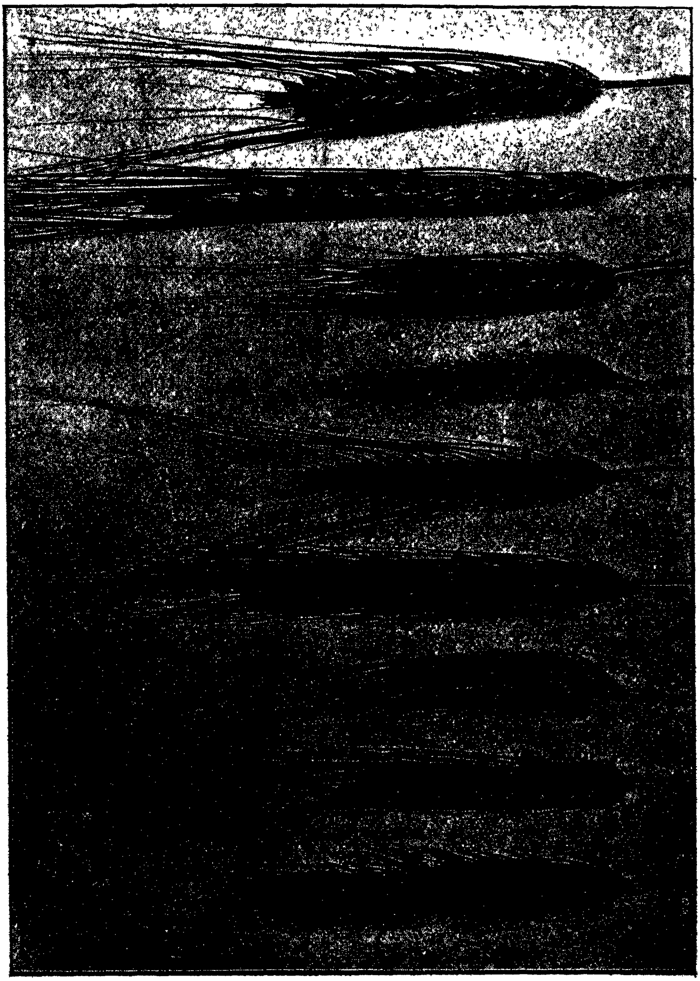


Plate XII.—Types of Barley from a composite cross, one-half natural size.

Bere variety. Evolved type. Chevalier barley.

Plate XIII.—Parent Barleys and an evolved type, 7-8ths natural size.

DAIRY MANAGEMENT.

By JOHN HART, Mains of Cowie, Stonehaven.

[Premium—£10.]

DAIRY management is a large subject including many parts, each of which must receive adequate attention if the best results are to be achieved. To enter minutely into all of these would require a large volume, but I shall endeavour to treat as fully as possible all important points.

Dairy Byre.

In order to show how to manage a dairy successfully, it is necessary to begin at the beginning.

The *byre* will receive our first attention. It should be roomy, well lighted and ventilated, but the greatest care must be taken to prevent draughts. Everything that conduces to the ease and comfort of the cow tends to increase the quantity and quality of her milk.

The *stall* should have a gentle slope towards a channel immediately behind the cows. This should run the whole length of the byres, and should have surface drains for every four, or at most six, cows, leading to one outside the byre, and falling into a liquid-manure tank.

The *floor* should be made of material that admits of being easily kept clean. It should always be kept as free as possible from anything that causes disagreeable smells.

The *inside walls* should be frequently cleaned down and whitewashed, and the bedding should be as clean, dry, and fresh as possible.

Dairy Cows.

The *cow* next claims attention. Upon the breed depends to a great extent the quantity and quality of her milk. It is a common error to suppose that any kind of cow can be fed up to giving a large quantity of rich milk. The truth is, no amount of feeding will make a Dutch or shorthorn cow give milk anything like equal in quality to that given by a Channel Islander; while the Channel Island cows, though nearly starved, will never yield milk so poor as that of a Dutch cow.

The *Channel Island* cows are no doubt the ideal cows for butter-making. Their fat-globules are large, rise quickly, the cream is very easily churned, and the butter, if properly made, is of a better grain, texture, and colour than that from any other breed.

The *Shorthorn* is, perhaps, one of the most useful for the dairyman, and with careful selection and breeding gives a very good yield of milk of good average quality. I have had several cross shorthorn cows which have given me on an average 1300 gallons of milk for ten months' milking.

The *Ayrshire* cow much resembles the Guernsey in shape and somewhat in colour, but her milk contains much smaller globules, and on that account is better suited for cheese-making.

The *Dexter Kerry* is a useful cow for butter-making, though the butter made from her milk is often pale in colour.

The *Dutch* cow gives a large quantity of milk, but it is generally of very poor quality. It is therefore not profitable for butter or cheese making; neither is it profitable to the consumer when bought in its raw state.

Improving Dairy Cows.—Although the characteristics mentioned are common to the different breeds, still we often find exceptions to the rule. So many points have to be considered by the farmer when selecting his cows, that it is impossible to lay down any hard-and-fast rule. Generally speaking, the first consideration is to get cows with strong constitutions giving a large quantity of milk combined with good quality.

I believe cows of all breeds are capable of great improvement as far as their milking qualities are concerned. Especially is this the case with those breeds which have not hitherto been looked on as dairy cows; as witness the case of the Aberdeen-Angus cow which gained the first prize in the milking trial at a recent show of the British Dairy Farmers' Association in London.

It may be generally admitted that any of the ordinary breeds of cattle will—if bred with that object in view—produce excellent dairy cows. If farmers would rear the heifers out of all their best milking cows, and serve them with bulls whose dams were noted for their milking powers, I am convinced that the results would prove satisfactory.

Feeding Dairy Cows.

The feeding of cows is a subject that might be dwelt on to almost any length; what I propose is simply to touch on a few of the points which appear to me to demand the particular attention of those who keep cows, whether many or few.

I take it for granted that the cows are of a class that it will pay to feed liberally, for those that are not good milkers should be at once fed off and sent to the butcher.

Quality of Food.—The first, and probably the most important, rule to be observed in feeding cows is to see that all food is

given to them in a clean, fresh, and wholesome state, and free from any objectionable flavour which might be communicated to the milk, cheese, or butter.

Grass.—In making up the feed of the cows we must, as far as possible, follow nature. Probably the best food for milk-cows is good, fresh, rich grass, as we have it, say, in the month of June and the early part of July; and if we are to expect a full flow of milk all the year round, then we are obliged to have recourse to other kinds of food. We must endeavour to combine these in such a way that they shall be at once palatable to the cows and have somewhat the same ratio as good grass, making such allowances as are necessary for the change of temperature.

Comfort in Byres.—In the winter-time the cows must be kept comfortably warm. Where possible, the temperature of the byres should be kept at about 57° Fahr. But this is not to be done by excluding the fresh air, and making the cows raise the temperature by the heat of their bodies and their breath, which, though a common, is a most pernicious method, and cannot be too strongly condemned. It is sure to undermine the constitution of the cow and make her an easy prey to disease, one of which is much to be dreaded, and is most loathsome in a cow—viz., tuberculosis. If the byres cannot be kept up to the degree required without stopping up all the holes that admit fresh air, then the best plan to adopt is, after giving the cow a good warm bed of dry straw, to clothe her and keep her comfortably warm. By this means a large amount of food will be saved.

Regularity in Feeding.—The cow must be fed regularly at the same hour every day. Give her as much well-balanced food as she will eat readily. The cow is a highly sensitive animal; she should get her food regularly and to her liking—if not, she will make her silent protest known in the milk-pail. Cows well repay kind attention and a liberal supply of food.

In making up the food ration of the cow, it is necessary to bear in mind that the first use she puts her food to is to maintain her body, and cows should be always kept in what stock-feeders call "good thriving condition." It is as great a mistake to allow the cow to get too lean as to permit her to become too fat.

Extra Food.—When cows have a sufficient supply of good, fresh, succulent grass, they do not generally require anything else; but as soon as the grass begins to go off it will be found profitable to give them some extra food: and care should be taken to see that they do not go off their milk at this time; for if once they are allowed to do so, it is scarcely possible to bring them up to it again. The change of feeding should

be made very gradually, beginning as soon as it is seen to be required. It is a good plan to grow a quantity of green crop to come in between the grass and the cabbage or early turnips.

Turnips and Cooked Food.—In the winter months, when cows are fed on turnips, it is a good plan to boil or steam part of them along with chaff, cut straw, &c. They can then be given to the cows along with draff or other feeding-stuffs, and a sufficient quantity of water at a temperature of about 80° Fahr.

I think, however, cows should always get a few of their turnips in the raw state, provided they are free from frost; but they should never be given before, but always after, milking, else they will flavour the milk and butter.

Concentrated Foods.—After the flush of the grass is past it will be necessary to give the cows some concentrated foods, but it is impossible to lay down any fixed rules as to what foods it is most profitable to use, as the prices and feeding qualities of these vary so much. The farmer would do well to be constantly testing the milk-producing qualities of the different foods in relation to their prices. Beans, peas, wheat, oats, and maize all give good results. They should be ground to a very fine meal, and steamed or mashed with boiling water and given as a thin drink.

These meals should not be cooked along with turnips, &c., but prepared by themselves and given separately immediately after their other cooked food.

The cow which is giving a large quantity of milk will, of course, get a larger supply of food than the one giving less milk.

Salt.—Cows should have a supply of salt constantly before them, and this can be best done by having a lump of rock-salt in the straw-rack in front of each cow.

Exercise and Water.—Cows when taken in for the winter should be allowed out every day, when the weather will permit, for half an hour or so, during the warmest part of the day, for a little exercise, when they may have an opportunity of getting a drink. But the cold air must be taken off the water before allowing them to drink, and this may be done by putting a few buckets of boiling water into the drinking-trough. On no account should the cows be kept standing up at the gate. Whenever they show a desire to get in, admit them immediately.

Cows not Machines.—While cows should get a liberal supply of well-balanced food and a sufficient quantity of water, on no account should artificial stimulants be given in order to induce them to eat or drink more than they desire. Some authorities on dairy matters tell us that cows are "simply machines" for

the production of milk. I do not think the simile is a very happy one. It is very liable to abuse. I have a suspicion that if cows were treated less like machines, and in a more rational manner, better results would be obtained.

Putting Cows Dry.—Cows should always be put dry two months before they are due to calve. I have found linseed-cake the best to give dry cows, while for cows in milk better results are obtained from the use of decorticated cotton-cake.

Turnip-flavour.—Some farmers are in the habit of adding *saltpetre* to the milk or cream in order to dissipate the turnip-flavour, when their cows are too liberally fed on these roots; this plan is not to be recommended. It is much better to scald the cream to, say, 140° Fahr., taking care to stir it all the time.

Water.

Since milk contains from 83 to 90 per cent of water, it is quite easy to understand that a reliable supply of good, pure water is indispensable on a dairy-farm. From whatever source it is derived, it should be perfectly clean and free from organic impurities such as are found in stagnant pools. If these have to be used, they should be often cleaned out, for it is difficult to exaggerate the importance of giving the cow the best and purest supply to be got. The deleterious ingredients in unclean water enter her system and often produce a more or less diseased condition of the blood, and many of the bad flavours and taints in butter and cheese might be traced back to this source.

Pure soft water being usually slightly warmer, is better than spring-water. If the cow is given her choice she will generally prefer the soft water. If she is getting cooked food, all the water she requires should be given along with it at a suitable temperature.

It is often observed that a sudden change from warm to cold weather causes the milk supply to fall off, and I have noticed that a drink of very cold water has the same effect. The cow has to keep up her animal heat, and contact with cold in any form, making heavier demands upon her blood to do so, an appreciable decrease in the quantity and quality of milk will be the result.

The same effects in regard to milk may be brought about by cold winds, imperfect shelter, lack of warm, dry bedding, rough treatment, driving by dogs, being tormented by flies, &c. If the cow is not kept in an easy quiet condition, and her comfort thoroughly looked after, she will, as far as possible, make good the deficiency from what would otherwise help to fill the milk-pail, and the farmer will be the loser.

The Dairy.

The dairy is the next point to be considered. The most important thing to be observed in this department is *perfect* cleanliness. This applies equally to a small or a large dairy.

If only butter is made, the dairy should be situated on the north side of the dwelling-house. To it should be attached a scullery for boiling water and washing up. The dairy should be dry, light, and well ventilated; the floor should be quite smooth and free from cracks, so as to be easily cleaned. No drain should be allowed inside the building, but the floor should gently slope to an opening in the outside wall, so that all water may pass through it and enter a drain outside.

The inside of walls, if of brick or stone, should be lime-washed at least every six months; and if the roof is exposed to the sun, it is a good plan to whitewash the slates during the summer weather, or where the inside of the roof is lathed and plastered, or lined with wood, a layer of sawdust of 2 or 3 inches thick put between the ceiling and the sarking-boards is of great assistance in keeping a more equable temperature throughout the year.

Nothing foreign to milk should be allowed inside the building. The practice of turning it into a larder or general storeroom cannot be too strongly condemned. Milk is a delicate fluid and readily takes any taint, which is often reproduced in the finished product. For this reason the dairy should be as far removed as possible from any bad odours.

Milking.

Milking is a part of the work of the dairy that is often not attended to as it ought to be. It should be done cleanly, quickly, quietly, and thoroughly, especial care being taken to see that each cow is milked thoroughly dry. It should be remembered that the last-drawn milk is very considerably richer in butter-fat than that first drawn, for the reason that the fat being lighter than the other parts of milk, floats on the surface in the udder as cream does on the surface of milk. Again, if any milk is left in the udder it has a bad effect on that which collects for the next milking, besides checking and reducing the secreting powers of the animal.

The milker should not have long finger-nails, as they sometimes pierce the flesh of the teats and cause soreness. The hands of the milker, the teats and the udder of the cow, should be quite clean before commencing to milk, and quickness, gentleness, and good temper should characterise the whole process.

The cow will invariably hold back her milk if roughly treated or influenced by fear.

The dairymaid when sitting down to milk should throw her whole attention and energy into her work. Milking should be done regularly at the same hours each day, and each milker should milk the *same* cows.

Weighing Milk.

Each cow's milk should be weighed immediately after every milking, and the amount entered in a book. This is very much more satisfactory than measuring it. The table will show how I keep my record-book.

Name.	Date when last calved.	Date due to calve.	August 1.			August 2.			August 3.			August 4.			August 5.			August 6.			August 7.			Totals.	Date when samples taken.	Percentage of cream on milk.	Remarks.
			lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.			
DAISY	July 1	Not served.	22	11	18	20	11½	17	21	10	17	21½	11	16¾	21	11½	17	22	12	16	22½	10	18	346¾	7th	14½	
MARY	Feb. 31	Jan. 15	22	..	11	22	..	10½	21½	..	11	21½	..	10	21	..	11	20½	..	10	20	..	9	221	7th	15	
DEWDROP	May 28	May 15	25	12	16	25½	12½	15	26½	..	26	25½	..	24½	24	..	25	26	..	25	25	..	24	357½	7th	13	
DANDY	Nov. 4	Oct. 10	10	..	8	10½	..	8	10	..	8½	9	..	8	9	..	8½	9½	..	8	9	..	7	123	7th	15½	
	Totals . . .		79	23	53	78	24	50½	79	10	62½	77½	11	59¼	75	11½	61½	78	12	59	76½	10	58	1048¾ $=102\frac{13}{41}$ gallons.			

At the end of each week the weight of each cow's milk should be added together, and again at the end of each month and year; then the total number of lb. should be divided by 10¼ (the average weight of a gallon of milk), when the yield of each cow can be ascertained at a glance.

Weighing the milk, however, is not all-sufficient, for the largest quantity of milk may be so poor as to be quite unprofitable for butter- or cheese-making. It may prove a source of profit to the producer if he can dispose of it in its raw state; but in that case the consumer would be the loser—although it must be admitted that the farmer who sells his milk in this state gets very little encouragement to produce a high standard of quality.

Testing Butter-fat.—There can be no doubt that the farmer who makes a quantity of butter will be well repaid by investing in

one of the more reliable butter-fat testers. For those who will not go to this expense, a simple, rough-and-ready, though, it must be admitted, not very reliable test, may be procured in the form of a glass testing-tube for each cow. These tubes are marked off with black lines into 100 parts. The whole of a cow's milk should be thoroughly mixed, and enough of it taken to fill a tube to the highest black line. When all the samples are taken, these tubes should be left undisturbed in a cool place for twenty-four hours, then the depth of cream may be read off, and the richness of the milk compared with the quantity and noted. The quality of the milk left below the cream should also be observed and noted; and those cows giving the largest quantity of richest milk should be kept, and those giving small quantities of poor milk got rid of as soon as possible. This test will give the *careful* observer some idea of the quality; but it is not to be depended upon for accurate results.

Importance of Testing Produce.—I cannot too strongly impress on farmers the value, nay, *the necessity,* of thus regularly testing the quantity and quality of the milk of each cow. It is the only satisfactory way of judging their real value. A case in point was brought prominently under my notice in the judging at a show held recently, to which I sent three dairy cows, all good-looking animals. One of them was placed first, another second, while the third did not get a place. Strange to say, this unplaced cow not only was considerably the best milker as to quantity and quality, but she was also the best breeder of the three—and yet the three gentlemen who acted as judges were farmers of great experience.

Treatment of the Milk.

As soon as possible after milking, the milk should be removed to the dairy and strained through a very close muslin. This is most important, for although everything up to this point may seem to have been quite clean, there will invariably be found some dirt on the muslin after straining. Here I wish to warn every one against using the wire strainers so commonly seen in dairies: I would as soon think of using a potato-riddle as one of these so-called strainers for cleaning milk. They are of no real use for keeping back dirt. If any readers are in the habit of using them, I would strongly advise them not to do so again until they have tied a piece of very close muslin under them, and I think they will be surprised at the result. It should always be remembered that unless the milk is thoroughly clean in the first place, we cannot have either good butter or cheese.

Composition of Milk.—I may here briefly explain the composition of milk and the character of some of its constituents,

as this will to a great extent explain the action of cream-raising. A drop of milk placed under a microscope of high magnifying power appears to be a clear liquid with a large number of tiny globular bodies floating about in it. These globular bodies are only distinguishable from the liquid by their outlines. This seems to be the most the microscope can reveal, but a chemist will divide milk into six distinct parts. He finds that 100 lb. of average quality milk contain, roughly speaking, $87\frac{1}{2}$ lb. water, $3\frac{1}{4}$ lb. fat, $3\frac{1}{2}$ lb. casein, $4\frac{1}{2}$ lb. milk-sugar, $\frac{1}{2}$ lb. albumen, $\frac{3}{4}$ lb. ash.

There are several conflicting theories entertained regarding the condition of the fat and casein in milk. That the fat is in the form of tiny globules is generally admitted, and the difficulty is to understand what relation the casein bears to it. That the fat is not free is quite evident, for if it were, being lighter than skim-milk, it would rise to the surface immediately it was allowed to rest, in the form of pure butter. But it is true that the two are intimately connected, as it requires the concussion of churning to separate them.

One theory is that the casein is in some way attracted to the fats, and remains in a sort of film around them. Another popular theory is that the fat-globules are covered with a skin or envelope of casein, and that it is this covering that prevents them from running together in one mass. This latter theory seems borne out by the whole process of butter-making, and I am inclined to favour it. I do not affirm that it is the correct theory, for it may be that further investigation may throw more light on the subject.

Now the fats in milk are lighter than water, but the casein is heavier. If the casein surrounds the fat-globules like a skin, as is supposed, then this theory would account for the cream rising slowly, and why it is of a whitish colour instead of yellow (casein being white); it also explains the fact why it requires concussion to abstract butter from cream—the bumping in the churn breaking these skins, and so liberating the contents. The globules vary in size from $\frac{1}{27000}$ to $\frac{1}{1500}$ part of an inch in diameter, and it is supposed that it is the fat that varies, and that the skin of casein is always the same thickness on all. This explains why the cream does not all rise at the same time, the largest globules rising first, because they contain the larger amount of lighter fat with the same thickness of casein. The others follow in their order, leaving about 10 per cent which never rise, owing to their small amount of fat being quite overbalanced by the heavier casein.

The fats are composed of about 68 per cent solid fats, which principally consist of palmitin and stearin, 30 per cent liquid fats, mainly composed of olein, the remaining 2 per cent

being principally composed of butyrin. The solid and liquid fats are fixed, but the others are volatile—that is, easily dissipated—and these are mainly responsible for the flavour of butter.

The proportion of solid and liquid fats varies according to the season, the solid increasing in winter, the liquid in summer. Casein very much resembles albumen; both are very like the unboiled white of an egg, but they differ widely in character. The albumen in milk coagulates with heat, and not by adding rennet or acids, while casein is not affected by the former, but coagulates with the latter. Both these constituents are present in a fine jelly form, while the milk-sugar and the ash are in solution.

The milk that comes immediately after calving is called *colostrum,* and greatly differs in composition from ordinary milk. Milk is a perfect food, containing all the constituents necessary to maintain life; but at this time it is evidently meant for the food of the calf alone, and should not be used in the dairy until it comes to its normal condition, which will generally be in about five days. Soon after this the yield of milk will be at its greatest.

Butter-making.

Cream Separating.—I will first assume that butter-making is the object, and deal with the milk and cream accordingly.

Now the first step in butter-making is to separate the cream from the skim-milk. This may be done by several different methods, but the most modern and successful appliance for so doing is no doubt the mechanical *cream-separator.*

I have used a cream-separator for several years and can testify to its great value. It has so many advantages over the old-fashioned setting methods, that I would advise any one who has to separate the milk from, say, ten cows and upwards, to invest in one, and I feel sure he will soon be repaid.

Advantages of the Cream-separators.—In the first place, the separator saves a considerable amount of time, for by its use one can have cream and skim-milk in a few minutes after milking. This is of great advantage to those selling milk, for both cream and skim-milk will be saleable for a much longer time. Then, again, it saves labour and room. A good working separator takes practically all the cream out of the milk. It has been proved that considerably more butter is produced from a given quantity of milk when treated in this way, as against the ordinary setting methods.

There are several makers of these machines, and they can be had for working by hand, horse, water, or steam power,

all constructed on much the same principles; and with each, successful separation depends mostly upon the temperature, speed, and the regulation of the inflow of milk.

Calf-rearing.—Though not strictly included in the subject of butter-making, calf-rearing is very closely connected with it. It must always be a matter of consideration to the farmer whether it is profitable or desirable that he should rear a certain proportion of young stock on his farm. If he makes up his mind to do so, then he must consider how it can be done most profitably.

One of the strongest arguments in favour of the use of the separator is that the skim or separated milk can be had in a perfectly fresh and sweet condition for the calves, and at a suitable temperature. I believe temperature to be quite as important for the feeding of young calves from the pail as it is to the butter-maker. I am convinced that if this matter were more carefully observed, there would be more separated milk profitably used for the feeding of young calves.

Separated milk contains all the constituents of whole milk, with the exception of fat and a very small proportion of casein, and I have no doubt that very good substitutes for the fat can be supplied at a very much cheaper rate.

Supplementary Food for Calves.—The kinds of food which the farmer may find most profitable to add to the separated milk for calf-feeding may vary according to prices; but the temperature at which the food is given must never vary—it should be from 85° to 87° Fahr. The young calf should be fed wholly on its mother's milk for at least one fortnight. After this, if a good price is got for butter, it will be profitable to gradually substitute skim for the whole milk, along with a quantity of one or other of the following mixtures, which should be carefully boiled or steamed, viz.—(1) linseed-meal and oatmeal in equal proportions; (2) linseed-meal, oatmeal, and locust-bean-meal in equal proportions; (3) linseed-meal and pea-meal in equal proportions; (4) 3 lb. linseed-meal, 1 lb. pea-meal, ½ lb. bean-meal, 1 lb. barley-meal, and 1 lb. oatmeal.

All the meals should be very finely ground, well mixed, and perfectly sweet and fresh. The calves should be commenced with a small quantity of whatever mixture is to be given them, and particular care should be taken to see that it is cleanly and properly cooked, and given to them after the milk has been added, at the above temperature.

Young calves should be kept in well-constructed, well-ventilated houses, kept in a cleanly, sweet condition. The houses should be in a warm situation, and free from draughts.

I cannot too strongly impress upon my readers the importance of cleanliness in the preparation of the food of calves.

The pot in which it is cooked should be thoroughly cleaned out after being used—in fact it should be so clean that one's porridge might be cooked in it. Depend upon it that the *calves'* sense of taste is as keen as ours; when their food has not been properly prepared they cease to relish it, and cease to prosper, and much labour and expense are thrown away.

Setting Milk.—If a separator is not used, then the best methods of setting milk must next be considered. The principal systems may be divided into two main classes, deep and shallow setting, which give about equal results.

With the *deep setting* the globules have further to rise; but they do so nearly as quickly as in the shallow system, because the deeper body of liquid assists their upward movement. Further, the cans do not take up so much room, and there is not such a large surface of cream exposed to the air.

In the *shallow-setting system* the globules have not so far to rise, and come to the surface a little sooner.

The *Swartz* and *Cooley* methods are two of the principal deep-setting systems. The former consists of deep oval cans holding from 4 to 8 gallons of milk. These are placed side by side in a cistern or trough containing, if possible, running water, which, if sufficiently cold, will keep the milk quite sweet as long as thirty-six or forty-eight hours in warm weather. The Cooley cans differ slightly from the Swartz in that they are round instead of oval, and have deep covers, which, although not fitting closely to the cans, prevent the water from entering, somewhat on the diving-bell principle. These cans are entirely submerged in water, and offer an advantage over the Swartz in that the milk is cooled from all round.

Of the shallow-setting system, the common basins are mostly used, and, if proper care is taken, fair results may be obtained by their use.

The *Jersey* and *Dorset Creamers* are much more to be recommended. They are double pans, with intervening space for the circulation of water, and they are provided with covers which admit the air, and at the same time protect the surface of the cream from dust. These pans are especially adapted for raising cream on the principle of a falling temperature. The milk is put into the inner pan, the temperature of it and the cold-water supply tested; if the milk is not 55° Fahr. higher than the water, sufficient hot water is put into the outer pan to raise it to that point, when it is run out, and the cold water allowed to run in. This plan affords a good range of temperatures for the milk to cool down. A rapid raising of the cream follows, and it is ready for skimming in about twelve hours.

Temperature and Cream-raising.—Here I may explain why the cream rises sooner with a falling temperature. The density

of an average sample of whole milk at a temperature of 59° Fahr. (which is the standard used) is expressed by the figures 1.031, water being 1.000. This shows that milk is considerably heavier than water. Now the density of milk is affected by heat and cold; heat causes it to expand, and it becomes lighter, while cold causes it to contract, and it becomes heavier. The fat-globules and the liquid in which they float are both affected by heat and cold, but not equally; the liquid sooner reaches a given temperature, and also more quickly recedes from it; but the globules are slower in responding. For example, if milk is surrounded by hot water, as in the Jersey and Dorset creamers, and heated to, say, 110° Fahr., then the warm water replaced by cold at, say, 40° or 50°, the liquid quickly cools down to within two or three degrees of the water; but the globules do not cool so quickly, and consequently there is more difference between the weights of the two, the liquid getting heavier, while the globules are comparatively lighter. This, of course, causes them to rise quickly.

Whatever system, however, of cream-raising is followed, a *falling temperature* must be the rule in order to raise as much cream as possible; and, practically speaking, our aim should be to set milk from 50° to 55° higher than that of the air or water used for cooling. During the winter-time the air temperature is often as low as 40°, and if the milk is set immediately after milking, this result is obtained; but during the warm weather more cream can be obtained by placing the basins or cans in cold water, or, if this is not possible, slightly raising the temperature of the milk, though the former method is much more to be recommended, owing to the danger of souring the milk by the latter method.

Besides the temperature, the rapidity with which the cream rises is also governed by the size of the globules and the condition of the other constituents.

Skimming.—The largest globules rise first, and if milk is skimmed after, say, twelve hours, the cream kept separate from other skimmings and churned alone, the butter will be of a better flavour, colour, grain, and texture than that skimmed at twenty-four or thirty-six hours. Great care should always be taken to see that the cream is removed from the milk before there is any danger of its being sour. It should be taken off with a perforated skimmer, so as to remove as little skim-milk as possible; for when sour it forms into a white curd, which may be distinctly seen after churning, and which it is impossible to remove completely either by washing or working.

The best utensil for keeping cream in is an enamelled pail, or next to that a glazed earthenware jar. Cream should never be kept in tin vessels of any kind.

Ripening Cream.—Ripening the cream is the next point that claims attention. Upon this a great deal might be written. Ripeness is necessary in order to obtain the full, rich, nutty flavour so much relished in good butter. Ripeness is that state of sourness when cream or milk is at its best for making butter.

Cream is sometimes churned sweet, but the butter is insipid and flavourless, and not so much is obtained from a given quantity of milk. Ripeness is brought about by organisms, or, as they are more commonly called, ferments. These are so tiny that they cannot be seen without the aid of the microscope, and then they appear like tiny specks of jelly.

The ferments proceed from germs which stand in much the same relation to the ferment as the egg does to the chicken, or as the seed to the plant; for they do not really belong to either the animal or vegetable kingdom, although it is supposed that they resemble the plant more than the animal. The germs are the seeds, so to speak, and the ferment the living plant. Ferments are always present in the air, and they attack and work upon any animal or vegetable substance that offers favourable conditions for their work—and these are moisture, appropriate food, and suitable temperature. When these are at hand, they multiply at a speed almost beyond conception. A temperature of from 95° to 97° is the most favourable for them; and as it rises above or falls below that point, they are rendered weaker and do not increase so rapidly. The ferments are not killed at freezing-point, though they are rendered quite inactive, and when brought into a warmer temperature they soon begin to work again. They are killed at a temperature of 140°, but the germs will survive a much higher temperature. In fact, the only way of ridding milk of them is by a process of successive heating and cooling, so that all germs may be effectually destroyed. Milk so treated and securely sealed could be kept for years.

Milk-ferments.—In milk two ferments have to be dealt with principally, which I shall call the casein and sugar (or lactic acid) ferments. The former is of an oval shape and works upon the casein in milk, tending to soften and break it up. This accounts for ripened cream churning more readily than sweet cream. The sugar-ferment is of a round form. It works upon the sugar in milk, turning it into lactic acid and producing the sour taste only too familiar to us all.

These ferments are very useful to the butter- and cheese-maker in the earlier stages of their work, and so long as they can be kept under control. But their usefulness is limited, and as soon as that point is passed, they produce fermentation, and finally putrefaction.

Methods of Ripening.—The increase of these ferments, and

consequently the ripeness of the cream, may be brought about by three different methods. In the first place, this may be done by raising the temperature and allowing it to cool again. For instance, if butter is to be made on a certain day, and the cream is very sweet, as it might be in winter, it should be heated up to 95° (being constantly stirred while doing so) the day before and allowed to cool, and if not sufficiently ripe by the next morning it should be heated again sufficiently early to allow it to cool down to the required temperature before churning-time. The second method is allowing the cream to ripen naturally. This may require four or five days in the cold weather; but if the air temperature be 60°, it should be sufficiently ripe in one or two days if obtained by either of the setting systems. The third method is by adding some ripened liquid, such as buttermilk. If the latter method is followed, the ripened liquid must always be mixed with the cream the day before churning and occasionally stirred. This last method, however, is not to be recommended except in experienced hands.

It is now possible to buy a supply of ferments to ripen sweet cream.

Over-ripeness.—As I have said before, butter made from unripened cream is more or less flavourless, and it also causes waste. Over-ripeness must also be guarded against, or there will be a difficulty in removing the casein, and the butter will sooner get rancid. It should always be remembered that one can easily forward ripeness, but that it is as impossible to bring it to a state of sweetness after it is once ripe as it is to make a ripe apple green. Great care should therefore be taken to see that the cream is not going too far ahead, and in order to retard the ripeness a little, the vessels containing the cream might either be placed in cold water, kept in a cool cellar, or wet cloths wrapped round them.

Testing Ripeness.—Blue litmus paper is often used to test the ripeness of cream. When this test is used, great care must be taken to see that the paper has been properly preserved. It must be kept in a perfectly dry place, as damp will render it useless. Litmus paper, when properly preserved, should be of a deep blue colour, and the whole of it should be exactly the same shade. Cream, when sufficiently ripe for churning, should turn the litmus paper into a brick-red colour.

But many people prefer to test the ripeness of cream by the smell and taste.

Churns.—Before describing the actual process of butter-making, I will explain the utensils best adapted for the work. There is first the *churn.* There are so many good churns in the market that it is a matter of opinion which is the best.

Good Points in a Churn.—As the object of churning is to

separate the casein from the fat, the buyer should select a churn that provides a good amount of concussion with as little friction as possible. It should be made of hard, dry, odourless wood, should have no crevices or corners, should be provided with a ventilator, a pane of glass to enable one to watch the progress of churning, and an opening large enough to admit of a scoop being easily put in and out for removing the butter, and, above all, easily cleaned.

The speed at which a churn should be driven must be regulated according to the make. One containing dashes should not be driven at more than forty to forty-five revolutions per minute, while the end-over-end does its best when driven at sixty. In order to test a churn for speed it should be filled about one-third full of water and driven at different speeds, when it will be quite easy to ascertain which speed gives the most concussion or bump.

Then, again, a churn has a proper working capacity. As a rule, it is not advisable to fill them more than one-third full. If over-loaded, the cream will swill round the churn, and this will produce friction, which will not do much towards bringing the butter.

There can be no doubt that the modern improved churn is of great advantage to the butter-maker, but with proper care and attention good butter may be made with almost any churn. I have made very good butter with the old plump-churn, in the bottom of the side of which I had a hole bored for letting out the buttermilk and washing water. A new churn should be washed out once or twice with soda-water, then with boiling water, then with buttermilk, and finally with cold water.

Butter-worker.—The butter-worker is a very valuable utensil. It consists of a plain or arched bed of hardwood, over which runs a roller, which is either corrugated the length of it, or round it after the manner of a screw. The purpose of the roller is to press the grains of butter into a firm compact mass, and to press out all the surplus moisture—not, as some people suppose, to get out the buttermilk, for this should have been done before it was taken out of the churn.

Scotch-hands.—Without these it would be impossible to make up the butter without touching it with the human hand, and this cannot be too strongly objected to. The pores of the skin are always giving off the waste material of the system, and this cannot come in contact with butter without injury to it. Then, again, the heat of the hand spoils the grain and texture of the butter, and this means spoiling its keeping qualities, besides rendering it soft and greasy.

The Thermometer.—This simple though valuable little instrument needs a special word of recommendation. By its constant

use there should be no uncertainty regarding the right temperature at which to churn and perform the other operations. For butter-making the floating glass thermometer is the best; being so small, and the outside entirely composed of glass, it is very easily kept clean. The scales for the temperatures, however, are not always exact, and they should be tested by a reliable one, which should always hang in the dairy.

The *other utensils* required for butter-making are sieve, scoop, pails, weighing-machine, a stirring stick, and squeegee.

Preparing for Churning.—The day before churning, all the cream should be thoroughly well mixed together and brought to almost the desired point of ripeness, and, unless in very cold weather, put in a cool place overnight; for it is very much easier to raise the cream several degrees just before churning than it is to lower it. The first thing to be done in the process of churning is to scald the churn, which should be done in the following way: sufficient boiling water should be put into it to come in contact with all the sides when turned round, the lid screwed tightly down, and the churn turned several times. It is necessary to press the ventilator every two or three revolutions in order to allow some of the steam to escape. The hot water should then be run out, and cold water put in to reduce the temperature of the churn to the desired point for churning. In cold weather one filling of cold water will generally be sufficient, but in hot weather this may have to be done two or three times unless ice is used. The water should remain in the churn until just before putting in the cream. Meanwhile, the butter-worker and all the smaller utensils should be scalded and then rinsed with cold water and rubbed with salt, which slightly reduces the temperature of the wood and prevents the butter from sticking, then more cold water should be poured over all, covered with wet muslin, and allowed to stand until the butter is ready for working. The water used should be as cold as possible in summer, but in winter it may be required at from 56° to 60° Fahr. in order to keep the butter in a workable condition.

The cream should next be prepared by slightly thinning if too thick (it churns best when yielding about 3 lb. to the gallon), and raising or lowering the temperature, as the case may be, to a point suitable to the temperature of the room in which the churning is to be done. The vessel containing the cream should be placed in a larger one containing hot or cold water as required, and constantly stirred until the desired temperature has been reached.

Colouring.—If any *colouring* is used, it should be added at this point. Nicholl's annatto is a very pure colouring, and does not impart any flavour to the butter. But whatever is

used, it should only be sufficient to give it a natural summer colour.

Churning Temperatures.—Here I will give a list of the temperatures followed in my dairy. The temperature of the air in the dairy should be first taken, and if, for example, it should be as high as 70°, the churn and cream should be reduced to a temperature of 53°, and the washing water lower still. Then, again, if the air temperature should be as low as 50°, then the temperature of the churn and cream should be raised to 62°, and the washing water should be 58°.

Air.	Cream and Churn.	Washing Water.	Air.	Cream and Churn.	Washing Water.
68°	54°		56°	60°	55°
66	55	45°	54	61	
64	56		50	62	
62	57		45		58
60	58	50	40	63	
58	59		35		60

By keeping to these relative temperatures butter should be obtained in much the same time at each churning, provided, of course, all the other conditions are the same. But different foods and breeds of cattle, and the state in which they are in, will cause slight variations.

Churning.—When the cream and churn have been brought to the desired temperature, and after running the water off and straining the cream through a cheese-cloth, churning should be commenced at once. The gas must be allowed to escape every ten or twelve revolutions at first, and until it has all escaped, by pressing the ventilator; or, if the churn is not provided with one, by taking out the plug. The churn should then be steadily driven until the butter breaks and forms in tiny little grains upon the glass. If the cream has been properly managed beforehand, and speed, temperature, and ventilation rightly attended to, this process should not occupy more than from twenty to forty minutes. If there is no glass in the churn, the sound may be some indication of the condition of the cream; for at this point the bump sounds more dull and heavy, and the churn seems heavier to drive. The plug may also be taken out, and if it is covered with smooth-looking cream, then the cream has not been broken; but if tiny little specks are visible, then the cover should be taken off, the temperature of the contents noted, and both the lid and sides of the churn washed down with a little cold water—about one pint to every gallon of cream may be used—and its temperature regulated by that of the contents of the churn: generally it will be required to lower the temperature. This helps to separate the grains, and gives them more liquid in which to float. The lid should then be replaced, and churning

slowly and cautiously done until the grains are about the size of mustard-seed.

Washing Butter.—Then the lid should be again removed, and it and the sides washed down with a little more water. As much of the buttermilk as possible should be drawn off through a sieve covered with fine muslin. Then about twice as much water as the buttermilk drawn off should be strained into the churn through a piece of muslin—the temperature of this water should vary, as noted in the above table. The lid must then be put on, the churn either rocked backwards and forwards or turned slowly two or three times, when the lid should be again removed, and it and the sides washed down, the water being then drawn off through the sieve as above.

The butter should be washed in this way until the last water is almost as clean when coming from the churn as when put in. If care has been taken to drain off all the buttermilk possible in the first place, three washings at most should be sufficient; but this depends somewhat on the size of the globules and the ripeness of the cream. The aim should be to get rid of as much buttermilk as possible with the least washing.

Over-washing butter dissipates the volatile fats which impart the fine flavour to butter, these being lost in proportion to the excess of washing. *Under-washing*, on the other hand, means much after-working in trying to get rid of the remaining buttermilk. This, however, cannot be thoroughly done, and any casein left in the butter hastens fermentation. The presence of casein in butter may improve the flavour rather than otherwise for a day or two, but after that it will very soon deteriorate.

Salt.—A little *salt* should be added to the last washing water, which should be allowed to remain in the churn for a little time. The salt helps to firm the butter in warm weather, improves the flavour, and also helps to preserve it. The quantity of salt used must be regulated according to the taste of the consumer. One half-pound added to each gallon of water will not perceptibly flavour the butter, while 2 lb. to each gallon will produce that degree of saltness generally desired in the South of England if allowed to remain in the brine for about twenty minutes. This latter method of brining the butter is superior to dry salting for imparting a slight degree of saltness. No working is required in order to thoroughly mix it with the butter. But this salting is not sufficient to keep butter several months. For this purpose dry salting must be resorted to. Of this I will speak later on.

Working Butter.—After washing the butter, the water should be run off from the worker, and it and the other appliances wiped dry. Then the butter should be lifted from the churn by the scoop, put into the sieve, allowed to drain for a minute, and then be placed on the worker. No more butter than can be

conveniently worked should be taken from the churn at a time, else it will get round the ends of the roller and the sides of the bed or table, which will cause waste, besides being very slovenly in appearance. After placing the butter on the worker, the stray grains should be gathered together and the whole mass lightly pressed with the "Scotch-hands." Then the roller should be passed slowly and gently over it. The roller should be pushed with the left hand while the handle is turned with the right hand. This prevents grinding the butter, which must be carefully avoided, as it spoils the grain. After passing over it, the roller should be rolled backwards, then the action should be reversed and the butter thereby gathered into a roll, which should then be cut in half and placed on end, with the cut ends uppermost—this allows the water to drain from it. Meanwhile the roller and bed of the worker should be wiped thoroughly dry, the butter placed against the roller and worked as before. This must be done without destroying the grains and until a bit cut in two shows no holes containing water, and a piece broken off breaks quite short, showing a fracture much resembling a broken piece of cast iron.

As regards workings, four or five is generally sufficient. Both *over- and under-working* must be guarded against. Under-worked butter retains too much moisture, while over-working spoils the grain and texture, and when this is the case the butter will not keep long.

Making-up Butter.—After working, the butter is ready to be made up into any form best suited for the trade in the district of the maker. It may be in lb. or ½ lb., in the form of rolls or bricks, and printed in any design. Bricks are easily packed and economise space. As for designs, people who make a large quantity of good butter might find it to their advantage to have one which would be a guarantee of their own manufacture, such as their monogram, the name of the farm, or some ornamental device, so long as it is neat and tidy. If a variety of designs are required, any number can be made on the top of the bricks by an ingenious person with the corrugated "Scotch-hands."

As the butter is made up, the bricks should be laid out singly, and never placed on the top of each other, and in the warm weather put into a cool place to get firm before being packed. For laying the butter on, there is perhaps nothing simpler or better than large, smooth, Welsh roofing-slates.

Butter-safe.—Those who have not a cool place for keeping butter during the hot weather should have a simple safe made of wood on legs, with a tank of slate, iron, or wood above it for holding cold water. This safe should have double sides and bottom, which should be filled with good dry sawdust, or lined with some non-conducting material such as felt. It should

have a close-fitting door and shelves made in the form of a rack.

Packing Butter.—The best wrap for packing butter is grease-proof paper, being both air- and grease-proof. Muslin may also be used, but never leaves of any kind. Boxes made of inodorous wood are best for sending butter long distances.

Devonshire Cream.

Devonshire cream is considered a great delicacy by some people. I will therefore explain how it is made. Some have an idea that it can only be made with milk from the Devon cows fed on Devonshire pasture. This is a mistake. It can be made anywhere, provided the proper method is observed.

As soon as possible after the cows are milked, the milk should be strained into small round pans—the ordinary shallow pans answer very well—and allowed to remain in the dairy undisturbed for twelve hours. They should then be placed on a hot-water stove made for the purpose, where a large quantity of cream is regularly made; but if only occasionally made, the pans may be placed on an ordinary kitchen-range, or in the boiler when the water is slowly boiling, and the same result will be obtained. They should be allowed to remain there until the milk reaches a temperature of 180° Fahr. The surface will then be covered with a thick wrinkled skin. They should now be gently removed to the dairy and placed on shelves, which should be made like a rack, so that the air may come in contact with as much of the under part of the pans as possible. After allowing the pans to remain there undisturbed for from twelve to eighteen hours, the cream should be quite thick and firm, and may then be taken off with a perforated skimmer, all the milk possible being drained from it. The cream should then be so thick, if made with rich milk, that it may be cut into squares; and if wrapped in grease-proof paper, it may be sent a considerable distance without injury.

Devonshire cream is generally made for eating with fruit, pastry, &c. Butter is sometimes made from it, but it is only of fair quality.

Butter from Lappered Milk.

In some districts butter is made from *lappered* milk. This, however, is a laborious process. The milk is allowed to ripen, and is generally churned in a streamlet churn, which is well suited for the purpose. It is of an oblong shape, divided across the middle by a partition reaching from the bottom to the lid, with a hole at the bottom of each end of it. On one side of the partition a dash revolves, while across the other side is what is

called a mid-feather, which slides up and down in grooves. This mid-feather is allowed to drop 2 or 3 inches into the milk; when the dash is in motion the milk rushes round through one hole, then through the other, and so under the dash again. As soon as the butter begins to form, it collects in a sort of drift behind the mid-feather, where it remains, being constantly added to until all the butter is obtained, when it is taken out, washed and worked on much the same principles as already described.

Whey-cream Butter.

In cheese-making districts, where most of the milk supply is converted into cheese, butter is often made from the cream that rises on the surface of the whey. The best butter of this sort is made when no great amount of acidity has been developed in making the cheese.

The whey should be run from the cheese-tub into a tank and allowed to remain undisturbed until the next morning, when the cream should be skimmed off. To each gallon of cream should be added about 3 gallons boiling water, and the whole put into a cool place for twenty-four hours, when the cream will have risen to the top, leaving the whey in the water. The cream should be churned as soon as possible, and the after-work carried out as in ordinary butter-making.

This butter is, of course, inferior to ordinary butter, but when salted and kept some months the flavour rather improves than otherwise.

Powdered or Salted Butter.

Butter intended for salting and potting should be carefully made on the same principles as butter to be used in a fresh condition; but the ripeness may be carried a little further, and no salt should be added to the last washing water. After working the butter, it should be weighed, then returned to the worker and rolled out; then very fine, dry, powdered salt should be sprinkled over it with a sieve, using half to three-quarters of an ounce of salt for each pound of butter. It should then be gathered into a roll with the salt inside it, then one end of the roll placed against the roller and rolled again. This should be done until the salt seems evenly incorporated through the whole mass. The butter should then be put aside until the next day, and then worked once more in order to get rid of any free brine.

Packing Salt Butter.—Then it should be very firmly pressed into stone or glazed ware jars, using a scoop or a piece of wet muslin rolled round the hand. Not more than 1 or 2 lb. should be put in at one time, as it is necessary that it should be well

pressed down all round so as to leave no air-holes. When the jar is almost full, the surface should be made quite even, and covered with a piece of parchment paper cut larger than the surface of the butter, so that it may turn up round the inside. A layer of dry salt should be put over the paper and pressed close round the sides. The jar should then be tied down with a stout piece of brown paper and kept in a cool place.

General Notes.

Cleaning Utensils.—Immediately after the butter-making is finished, all the utensils should be thoroughly cleaned, by washing first with warm water and finally with boiling water, and then left in an airy place to dry. All basins and other utensils which have been used for milk or cream should be first washed with cold, then warm, and lastly with boiling water.

Good Butter Anywhere.—Here let me add that good butter may be made anywhere, and with almost any utensils, if proper care and thorough cleanliness are observed. Of course, flavour and quality will vary somewhat according to the breed of cows, herbage, &c.; but on the whole none of these differences should prevent good butter being made.

Essentials.—Before leaving this part of my subject, I should like again to impress on my readers the necessity of strict attention to the feeding of the cows, to the matter of temperature, and, above all, to cleanliness. Cleanliness is simply an absolute necessity in all departments of dairy work if we are to secure the best results. True, we are sometimes told when emphasising this point, that everybody knows that already. The pity is that, if everybody knows it, so few should put it into practice, or that it should be so seldom seen in dairying. Mrs MacClarty, no doubt, thought that she knew quite well what cleanliness was, and put it in practice in her own way; but her own way was hardly an ideal one for the dairy. Unfortunately, Mrs MacClarty's bairns still live, and some of them, I fear, are in the dairy business, and from such what can be expected?

To have first-rate dairying we must have dairymaids as clean in their person and work as *pure water.* To get that we must have it learned by children in childhood, taught at school, enforced at home, and practised in all departments in after-life.

CHEESE-MAKING.

The object and aim of cheese-making is to gather together as much of the solids of milk as possible, manipulate them so

that the finished product is brought to a more or less dry state according to the system followed. A system consists of a number of rules, which, when properly applied, make a particular kind of cheese.

We sometimes hear it said that breed, herbage, soil, and climate are responsible for the good and bad flavours of cheese; but this is rarely if ever the case. There may be slight variations, but, as a rule, these are not sufficient to prevent good cheese being made anywhere, provided a proper system is followed in all its details, and a proper well-kept dairy, good utensils, and sufficient knowledge are at hand. If a Cheddar cheese is desired, that particular system must be closely followed, and the same applies to any other make.

Then, again, it is often supposed that a particular kind of cheese cannot be successfully made in any other district or county than that where it is commonly followed. It is, for example, no rare thing to hear people say that Stilton or French cheeses cannot possibly be made in Scotland. This, however, is a great mistake; for if the cheese be made and cured according to the rules which govern these systems, they may both be made here with very good results.

If the mixed milk of a number of cows were divided into half-a-dozen lots, and each lot treated after a different system, the result would be six different kinds of cheese, each possessing a distinct flavour, shape, and character of its own.

Constituents retained in Cheese.—Whatever system is followed, the following constituents of milk are retained in well-made cheese: almost all of the fat, casein, and ash, with only a very small proportion of albumen, sugar, and water, the last three varying according to the amount of moisture left in the cheese. The whey consists of most of the water, albumen, and sugar, with only the smallest amount of fat, casein, and ash.

Properties of a well-made Cheese.—The following properties should characterise all well-made cheese: a pleasant, nutty, fine flavour; mellow, soluble, rich quality (the latter, of course, is impossible with skim-milk cheese); even, natural colour; good keeping quality; convenient size and shape; and, above everything else, digestible.

Dairy for Cheese-making.—The size of the dairy must depend largely upon the quantity of cows kept on the farm for cheese-making. It should be constructed suitable and convenient for the system followed. It should be large enough to contain all the necessary appliances and still leave sufficient room for easy working. If it is too large, time and labour are lost in keeping it clean; but seldom if ever do we find a dairy too large. It should be well ventilated, and all windows should open so that as much air as possible can be admitted when desired.

Adjoining the dairy should be the scullery, and if possible a pressing-room. The curing-room is preferable above the dairy-room; but if not, as near as possible, and it should be up-stairs. Curing-rooms on the ground-floor are not so good for ripening the cheese, but in a few cases they are preferred. It too must be well ventilated; but the ventilation must be under perfect control, for draughts are hurtful to the cheese. The ceiling should be covered over with 3 or 4 inches of sawdust, to prevent the heat of summer from getting at the cheese. Blinds should be put on the windows, as the sun is hurtful to the cheese directly opposite them. In the autumn, winter, and spring time it should be heated by hot-water or steam pipes, or by a stove, the two former being preferable to the later.

Utensils for Cheddar Cheese-making.—I will mention the utensils necessary for Cheddar cheese-making, and will afterwards describe the process of manufacture. I take it for granted that every dairy is supplied with a boiler and connecting apparatus for the generation of steam, or a good well-built copper for the supply of hot water. The milk-vat may be either oblong or round—I prefer the former. It should have a double case, so that the space between them may be filled with hot or cold water; the outer case should have a couple of taps for letting off water, and the inside case provided with a good large one for letting off the whey. The front legs should be a little shorter than the hind ones, two blocks of wood being placed under them to keep the vat level; when the vat is to be tipped they should be taken from under the front ones and put under the back ones. The vat should be balanced on two wheels in the centre; by this means it can be easily moved about.

Along with the vat should be a measuring-rod and strainer, the latter to keep the curd from passing through the tap when letting whey away. Also two knives for cutting curd when coagulation takes place—a horizontal and a perpendicular one. The perpendicular knife consists of a number of blades, nearly 1 inch in width, sharp and very thin, corresponding in length with the depth of the vat in which it is to be used, standing parallel to each other, and attached to a horizontal bar or bars, equidistant from each other three-eights of an inch; a handle should be attached to the top. The horizontal knife is made in the same way, but the blades run horizontally, being attached at the ends to perpendicular bars; they should be half an inch apart. Both of these knives should be made of the very best steel and well tinned, very thin and well soldered together. There is also a curd-rack or cooler for stirring and packing the curd when separated from the whey, and a good thermometer, which should be thoroughly correct

and easily cleaned—a degree wrong makes a very great difference in the process of making.

Where a large quantity of cheese is made a strainer and siphon are very useful for letting off the whey. The strainer should be the depth of the vat, circular in shape, and made of perforated zinc, well tinned. The siphon is simply a bent pipe with arms of unequal length. It is held in the whey until full, when the ends are closed with the palms of the hands, then lifted out—the short end being then put inside the strainer (keeping both ends closed until it is in position) and the other end in a pipe or pail in which the whey is to be run off.

A curd-scoop, brush, a measuring-glass for rennet and colouring matter, and a curd-mill for grinding or milling the curd, are likewise required. The last-named should have a roller with spikes running in an open grating below so as to tear the curd apart. It should have a large tin basin for holding the curd when milling. Weighing-machine and weights are required for weighing curds and salt. The cheese-hoops or chessets should be round, the diameter and depth being about equal. Care should be taken to have the lids or sinkers a proper fit for the chessets. The cheese-presses, of which there should be two or three, are best made of iron, the pressure being given by levers, which can be increased or decreased by adding to or taking from the weights at the ends of the levers. Then there are the milking-pails (which should be made of tin), cans for carrying the milk from the byre to the dairy, cheese-cloths, bandages, &c., &c.

History of Cheddar Cheese.—Cheddar cheese was known as far back as the sixteenth century. It was first made in Somersetshire,—some say it originated in the village of Cheddar (from which the name of the cheese was taken), while others maintain that the monks of Glastonbury Abbey first made it. To whom or to what place the honour belongs is uncertain, but it is known that the making of this cheese was for a long time confined to the county of Somerset, and for a number of years it was thought impossible to make the cheese outside of it. There can be no doubt that some of the finest Cheddar cheeses have been made from the grand old pastures of Somersetshire, but in later years the dairy-farmers of the south-west of Scotland have been holding their own with them. Somewhere about forty years ago the late Joseph Harding of Somerset taught the principle of Cheddar cheese-making in Ayrshire and some other parts of Scotland, as practised by him. That system has now entirely disappeared; and the Canadian (Drummond) system is now followed by most of the best makers in the south-west of Scotland.

For the following notes on the improved methods of making Cheddar cheese on the Canadian system I am indebted to Mr

Henry M'Fadzean, Instructor in Cheese-making in the counties of Wigtown and Kirkcudbright:—

Process of making Cheddar Cheese.—I will now explain the process of making.

Let it be understood that a square or oblong vat is what is used. Considering the subject as a single day's work, our duty begins the night before, and here let me say that *thorough cleanliness* in every detail of dairy work goes a long way in ensuring success in that particular branch, and that the smallest item ought never to be overlooked.

Treatment of Milk.—The evening's milk should be brought from the byre and strained into the vat—if convenient, it should be strained into a receiving can, which should be inside the press-room or scullery (the former preferred), and run gently along a conductor into the vat. This allows the air to get at it and cool it, and also the animal heat taken off. Milk for cheese-making should not be put over a refrigerator, if it can be done without. After being put into the vat the temperature should be found, and if too hot, it can be cooled by using cold water inside the jacket of the vat. It should be left so as to find the temperature about 68° in the morning. Some dairies would not do with so high a temperature in the morning, while others would do with a degree or so more; but when the temperature is too high the flavour is never so good, and, as a rule, the process of making is too quick. The object of regulating the temperature is to secure in the morning, at the time when we wish to begin work, that condition of *ripeness* essential to the success of the whole work. Care should be exercised as to the weather when setting the milk at night—in a clear bright atmosphere you can set milk deeper than you can in a close muggy night.

In the morning the first duty is to take the *temperature* of the evening's milk, and then skim off the cream into a milk-can. The cream can be heated by applying two times its quantity of new milk. The purpose of skimming is to get a more even distribution of the cream than could be done by adding the morning's milk to the evening's without lifting it. If any of the evening's milk has been set in coolers or plates it should now be put into the vat.

Addition of Rennet.—Having all the milk together, we now get it raised to a temperature of 84° (in the spring and autumn I prefer 86°), and find if it is ready to add the *rennet*. To ascertain if ready for the rennet we use a test—sometimes litmus paper is used, and when acid enough to receive the rennet it will change colours. This test is very seldom used. Another test, and a more reliable one, is to take a drachm of extract of rennet and 4 ounces of milk from the vat and put

both into a cup. The cup should be the same heat as the milk. If coagulation takes place in twenty-four seconds, the milk will be ready for the rennet. Some places differ from others on the number of seconds taken; but you can easily find out for yourself what your dairy requires, as if twenty-four is too slow, then wait on till you get twenty or twenty-one, and if too quick, try twenty-seven or twenty-eight,—alter to suit yourself. This test is reliable if rightly used.

Sour whey should never be used to ripen milk. If the milk is too sweet wait on it, and next night regulate the setting of the milk. So as to have it a little further on in the morning, you can set it a shade deeper. Do not add the rennet until you have the desired ripeness; by getting the milk into a certain condition before adding the rennet much time is saved in a subsequent part of the work. It is a known fact that milk ripens best when its elements are all together and intact.

Colouring Matter.—If *colouring matter* is used, it should be added to the milk at least thirty minutes before the rennet, and properly stirred; colour according to taste, but from $1\frac{1}{4}$ to $1\frac{1}{2}$ ounces per 100 gallons of milk is an average quantity—that is, if your annatto be good and well kept.

Quantity of Rennet.—Now add the *rennet extract.* Four ounces should be sufficient for 100 gallons of milk. Stir well for four minutes, and keep the top in motion until coagulation takes place, so as to prevent the cream from rising to the top; then cover the vat with a cloth until ready for cutting with the knives. Some dairies can do with rather more rennet than others. If you use home-made rennet you must find out the strength of it, as it is never so strong as the extract, and use what you require.

Home-made Rennet.—Until quite recently it was the practice for farmers to make all their own rennet; but that has now to a great extent disappeared. For those, however, who desire to make their own rennet I shall describe how to do so. It is made from the stomach of the calf, and calves should be fed for a few days before being killed. It is the coating of the stomach that contains the concentrated strength of the rennet, and care should be taken of it and carefully handled and salted. Put the stomachs into clean cold water. If the water is not pure, boil it and let it cool. Allow this to stand for three days, rubbing and stirring them several times. At the end of three days take them out and put again into clean water with the addition of a little salt, and allow to stand for a couple of days, rubbing and stirring occasionally. After this wring them well and put them out, mix both together, and have it properly strained and filtered and put into jars. I should think a dozen should make a gallon of good rennet. By no means steep

stomachs in whey. You must try and keep the rennet as pure as possible.

Cutting Curd.—*Coagulation* will now have taken place, from forty to forty-five minutes being a proper time for this. When the curd is ready to cut it should split clean off the finger. The prevalent belief among experts is that the action of rennet has got almost nothing to do with the ripening process of a cheese. Great care must be taken not to bruise the curd in cutting. Use the knives described, and cut lengthwise, then across with the upright or perpendicular knife, and then exactly the same way with the horizontal one—this knife should be put gently into the curd and not lifted out until finished cutting. You should now have nice-sized curds—they should be the size of good peas when finished cutting. If, however, you think them too large, raise all the curds up with your hands and cut across the vat with the perpendicular knife.

Heating Curd.—The curd should now be stirred very gently with the hands for fifteen minutes, and then the heat should be applied, and gradually raised to the desired temperature in about forty-five minutes: 100° is the temperature of scalding; some places go a shade higher,—richer milk generally requires a degree or two of more heat. During the time of heating the curds may be stirred by a rake something after the shape of a hay-rake, but having teeth on both sides. Care should be taken not to heat too quickly, as you are apt to incrust the external surface of the blocks of curd. Stir very gently, so as to keep the whey clear and green. By cutting with these knives you save the curd, and the whey has almost no fat left in it. The object of stirring is to expel the moisture from the curd, and it generally takes about twenty minutes' stirring after the "desired" temperature is reached before you get the firmness required which is essential for the cooking of the curd the time it lies in the whey before acid appears, or acid enough to take out of the whey. The curd should lie from forty-five to sixty minutes after you finish stirring before it is ready to draw the whey. To know the point at which stirring should cease requires a good deal of experience; but when squeezed in the hand the curd should be firm and springy, or, when rubbed, should separate freely. The vat should be covered with a cloth until the whey is ready for drawing, and the heat should be kept up, or as near as possible.

Drawing Whey.—The test for knowing when the acid appears is by using a *hot iron*, black heat. When you apply the curd (a small quantity well squeezed in the hand) to it and get it to draw fine silky threads a quarter of an inch long, then it is ready to draw the whey. But here lies the great secret of cheese-making—to know the proper time to draw the whey

when the acid appears. Having got your desired acid, you remove the curd to the racks placed inside the cooler, which should be covered with a large cheese-cloth, and stir well for a few minutes, so as to expel a portion of the whey or moisture; but care must be taken not to stir too long at this stage. If you stir too long and expel too much moisture, you generally have a firm dry cheese. Only enough of moisture must be left so that the curd may mat together and mellow down and be ready for the curd-mill. After stirring draw together to a depth of 6 inches, cover well with dry clean cloths, and allow to stand for twenty-five minutes, until it has become solidified—a process we call matting. Now cut it in squares of 8 inches, and turn it over; allow it to lie half an hour, then turn again and put it two or three pieces deep; let it lie another half-hour and turn again, and so on until ready for milling. This, if the whey has been drawn off the curd at the proper time, should be in about two hours. Again we use the hot-iron test, and when ready for milling the curd should draw fine silky threads from 1½ to 2 inches long. The temperature of the curd during the time it is in the rack should be about 90°.

Milling Curd.—Now that the curd is ready to *mill*, we weigh it to find out what quantity of salt is required. The curd should not be milled too fine, as you are apt to separate the butter-fat from the casein, and this is liable to be lost in pressing. After milling put it back into the cooler and thoroughly stir; you will then get rid of any gases or smell the curd has, and principally in this way you will be getting it ready to take the *salt* by the action of the air.

Salting.—To the inexperienced it is difficult to know when *ready for the salt*, but when pressed in the hand it should have a nice soft velvety feel. Experience is what is chiefly required to tell when it is ready for the salt. If a curd is salted too soon—that is, before it is ready for it—the cheese, when ripe, will "pale" open and porous. Time should be taken at this stage, and the curds will be all the better to lie covered with a thin cloth for fifteen minutes after stirring and before salting.

Quantity of Salt.—In making deep Cheddar cheese, you will require 1 lb. of salt to every 50 lb. of curd. Our makers must use their own judgment as to salting, as there is no firm or fast rule to lay down for that. Salt has a tendency to dry the cheese, so that if you use too much salt you will have a hard dry cheese, and one that merchants do not want. On the other hand, if your curd be moist you can use more salt, as part of the salt will come out by pressing. Cheese meant for the English market should be soft and meaty: then these require less salt. Having added the salt, care should be taken to have it properly mixed with the curd.

Pressing.—In about twenty minutes after salting, the curd should be ready for the chesset. Now for the first time we allow the temperature to go down. From 72° to 75° is a good temperature for chesseting at. It is a great mistake to allow the temperature to go too low, and also to allow the curd to stand too long in the salt, before chesseting. No fear need be entertained of loosing the butter-fat at that temperature by pressing. If a cheese is rightly made, the fat won't press out. You will have a much closer-cutting cheese, when ripe, by pressing at that than allowing it to cool to a low temperature. Press gently at first, and gradually increase the weight until you have full pressure on, in about two hours after going to press. Thirty to forty hundredweight (30 to 40 cwt.) is little enough pressure for a Cheddar cheese of from 75 to 100 lb., and it takes three days to thoroughly press them.

All cheese should be changed the night they are made and get a cloth wrung out of tepid water, and be turned upside down in the chesset, so as to get a more even distribution of the moisture through the cheese. Next morning we recommend a bath in water of 120°, the cheese to be kept in it a couple of minutes. Then press gently for two hours; then change and give a dry cloth and full pressure during the rest of time. Change and put dry cloths on every day they are in press.

Bandaging. — All cheese should be *bandaged* with cotton before going to the curing-room. Some people put caps or hoods on the cheese. This is a very good plan, as it keeps the cheese clean and free from chips. The cheese should be well rubbed with butter or good lard before being bandaged. A strip of cotton 4 inches in width and of sufficient length makes very good bandages. This should be neatly put on, and a small ticket, with the date on which the cheese was made, gummed on to it.

Curing.—The cheeses should now be taken to the *curing-room* and turned every day until they are three months old. Great care should be taken of the cheeses in changing in the chesset and turning in the curing-room, as a slight chip or damage to the edges spoils the look of them, and merchants won't give so large a price for them as for well-handled, good, stylish cheese. Chessets should be all the same size, and the cheese should be finished in the one in which they are started in. But the chessets must be carefully kept and washed every time they are used.

The temperature of the curing-room must be kept as even as possible. A good temperature to ripen at is 65°; but in hot weather it is often above that, and when it rises higher, care should be taken to cool the room at nights with a slight opening of the windows and ventilators.

Cheese-making Register.—All makers should keep a cheese-making register and mark daily everything done. The register should have the following headings: Month, Date, Quantity of milk, Temperature of evening's milk in morning, Seconds tested at, Time of ripening, Quantity of colouring, Temperature at which rennet was added, Quantity of rennet, Time when added, Time of coagulation, Temperature heated to, Time of heating, Quantity of curd, Time at which curd was milled, Quantity of salt, Time when salted, Time settled in whey, Number of cheese, and Remarks.

Cleanliness is the first and most important point in cheese-making. Everything connected with the dairy should be kept scrupulously clean to ensure success in making good cheese.

Skim-milk Cheese.

The great things to guard against in making and curing skim-milk cheese are hardness and dryness. If made on the Cheddar system, the curd after being scalded should not be brought to the state of firmness desired when using whole milk. Scalding should cease sooner, when the curd is in a softer condition. Less pressure will also suffice, while when curing the air should contain more moisture.

Derbyshire System.—I have made cheese from separated milk on the Cheddar and Derbyshire methods, and have found the latter to give most satisfaction, so I will describe that process of manufacture.

The cheese-vat best adapted for this system differs considerably from the ordinary one. It is of a round form, and inside there revolves a frame in which knives are set for cutting the curd, the knives being taken out when cutting is finished. Then a flat perforated plate about ½ to 1 inch less diameter than the tub, which is attached to a straight rod connected with a frame above the tub, and worked by levers, is let down on the curd; at the side of the tub are three taps—one near the top, one half-way down, and the other at the bottom. As soon as the curd has settled, the plate is allowed to sink lower and lower as the curd contracts, and as it gets below the top tap the whey is drawn off by it, and again as it sinks below the middle one; and when all the whey that it is possible to remove by this method is drawn off, the curd is cut round the sides and piled in the centre and pressed again, the weight being slightly increased until the desired point of dryness is obtained.

A more common appliance, however, is a square or oblong tub for draining the curd, in which racks can be placed on the bottom and at the sides. This greatly helps the whey to escape,

and it runs off by a plug-hole at one end. A cloth is laid in the tub, the curd put in it, and pressure applied by a beam or pole worked by a lever at one end, and to which weights are added at the other end.

Although these appliances are very useful, they are not necessary. I have been making cheese on this system with the ordinary oblong Cheddar vat with only one tap.

When making cheese on the Derbyshire system, the ripeness of the milk should not be quite so far advanced as in the Cheddar system. The rennet should be added at a little higher temperature, say from 85° to 88°, according to the weather and quantity of milk, and enough should be used to produce a curd ready for cutting in one hour.

The curd is cut with the same knives as those used in the Canadian Cheddar system—first with the perpendicular and then with the horizontal one. These must be used very gently at first, for the curd being very tender at this stage, it is easily smashed, and a quantity may be lost in the whey; but as it gets smaller and firmer the speed may be gradually increased. Care must also be taken to see that all the curd is equally cut, and when the pieces are reduced to the size of beans it should be allowed to settle for a few minutes, then pressure must be brought into use.

It is in this particular point that the Derbyshire system differs from the Cheddar—while heat is applied in the latter, pressure is used in the former in order to extract the whey.

A light rack made of thin strips of wood nailed on two cross pieces is very useful for pressing the curd. It should be the same inside width and depth as the vat. It should be pressed gently down on the curd with the hands, moving it about so as to cover all the surface of the curd, until it seems close together. The rack should then be covered with cheese-cloth and inserted upright at the tap-end of the vat and drawn to the middle. This will allow the whey to drain off more effectually. When as much of the whey has been got rid of in this way as possible, the rack should be taken away, and the curd piled at the end of the vat and covered with clean cloths. The rack should then be put on the top with a small weight upon it. If a rack is not used, then the curd may be pressed down with a sieve, going several times round the tub.

The greatest difficulty under these circumstances is getting rid of the whey; for having nothing to keep the curd back, it clogs up the strainer, which requires to be constantly cleaned.

After being piled, a piece of board with a weight on it might be put on the curd: this should be taken off every few minutes, and the curd cut into pieces, and piled again, always adding a little more weight until the curd seems firm and rather dry.

It is at the next stage that the wooden tub referred to above is an advantage. A clean cloth is laid in the tub and the curd lightly broken into it with the hands, covered with a cloth, and either the rack or a board put on the top of it, on which a block of wood should be placed for the beam to rest upon, a small weight being used at first, and gradually increased until 15 or 20 lb. is used.

Where a tub of this kind is not used, the curd should be broken into the largest hoops at hand, and pressure applied by using anything convenient provided it is clean.

In this condition the curd is allowed to remain until the following morning, when it will be considerably drier, and fermentation will be much further advanced. It is then cut into slices and ground, after which salt is added at the rate of 1 lb. to 50 gallons of milk and thoroughly mixed. Formerly the salt was not mixed with the curd, but rubbed on the outside after the cheeses had been in press from twelve to eighteen hours. They were then not generally more than 5 or 6 inches deep and of a larger diameter; but now that it has been found better to mix the salt with the curd, it is not necessary to keep to this shape, although it is generally adhered to in the county where these cheeses are mostly made. After salting, the curd is put to press in the same way as the Cheddars; but for cheeses of from 10 to 12 lb. in weight about 1½ cwt. is sufficient for the first day, and about 4 cwt. for the last. After coming out of the press these cheeses are treated as above recommended for Cheddar cheese, excepting that the air of the curing-room should contain a little more moisture.

Cream Cheeses.

A real cream cheese is, as its name denotes, made entirely from cream. Sometimes, however, they are made from half cream and half milk, and not uncommonly these latter are sold for whole-cream cheeses.

Cream cheeses belong to the fancy class. They are very rich, and for this reason are made very small, often not weighing more than from a quarter to half a pound. They are ready for consumption immediately after they are made. Being soft, they will scarcely keep a week in warm weather. Consequently they should not be made in large quantities unless there is a ready demand for them.

The best cream for cheeses is the thickest obtainable. Cream intended for this purpose should be kept in a separate vessel and allowed to ripen a little beyond the point desired for butter-making. For example, separated cream kept for three days in an air temperature of 60° Fahr. produces about the

right amount of ripeness; and if ripeness does not proceed fast enough, it may be hastened by heating up the cream in the same way as for butter-making.

When sufficiently ripe, the cream should be put into a cloth of either very fine linen or thick huckaback towelling, so as to allow the moisture to drip from the cream. The ends of the cloth may be either gathered together and tied round with a stout piece of string and hung on a nail, with some vessel under to catch the drippings, or it may be tied over any large vessel, the liquid falling into it. In this case something should be put over the cream to prevent the dust from falling into it. About every four or five hours afterwards the cloth (if tied up) should be opened and the cream moved away from the sides of the cloth, and all well mixed together, for that nearest the outside will get dry and prevent the moisture from the inside escaping. (A wooden knife is best for this purpose.) This must be done until the moisture has practically ceased to drip, which is generally in two or three days.

At this stage pressure must be used to further extract the moisture—the drier the curd is the longer will the cheese keep. The curd should next be put into a clean cloth, tied tightly, and put on something slightly inclined—a flat piece of board raised about 2 inches at one end answers very well. On the top of the curd should be placed another piece of board, and upon it some weights, beginning with a pound or two and gradually increasing until 20 or 30 lb. are used. The curd is generally sufficiently pressed if this weight is allowed to remain on overnight.

On the following morning the curd should appear quite dry and firm, and a piece broken off should be not unlike a piece of butter broken. After being pressed it must be worked by kneading it with the wooden knife.

If salt is to be used it should be added according to taste at this point, so as to be well worked in. Salt helps to preserve the cheese; but when a sweet cream cheese is preferred, a little of any of the best preservatives may be used for the same end.

After kneading, the curd should be like a very stiff smooth paste. It is then ready for moulding. The moulds should be square. They are best made of tin: two or three different sizes may be used, holding from ½ to 1 lb. of curd, and from, say, 1½ to 3 inches deep, with open ends. Put in two strips of grease-proof paper the width of the moulds and crossed in the centre, these being long enough to reach up the sides and overlap a little. The mould should then be put on an even surface and the curd pressed into it with the knife, care being taken to see that the corners are filled. When full, the surface of the curd

should be made even and the paper folded over and the mould lifted off, leaving a nice square cheese entirely covered with the paper.

As already stated, they will not keep long; they should, therefore be kept in a dry cool place.

Cheeses are sometimes made, as mentioned above, with half cream and half milk, using a very small quantity of rennet to coagulate and thicken the curd. The result, of course, is a cheese of a different flavour and not nearly so rich, and it should be sold as half-cream cheese.

TILLAGE IMPLEMENTS: OLD AND NEW.

By PRIMROSE M'CONNELL, B.Sc., Ongar, Essex.

THE beginnings of Tillage Husbandry are lost in the mists of antiquity. The monuments of ancient Egypt prove to us that more than five thousand years before the dawning of the Christian era there were tribes in the valley of the Nile becoming gradually consolidated into one powerful nation, and that, even in that remote age, they were skilled in many arts and manufactures, and especially in all kinds of farming. The implements of cultivation were, of course, comparatively rude in construction, though they contained the germ and principles of the most modern forms; and it is remarkable that to the present day the same forms are adhered to throughout the East. Not only in Egypt, but all over the countries which comprised the "ancient world," the tools of all sorts are almost identical with those represented on those renowned monuments—monuments that were hoary with age when Belzoni's mummy was alive.

The progress of agriculture has been very slow—in fact, if it had been left to those Eastern peoples it is doubtful if it would have progressed at all. It is only during the few centuries in which the western and northern nations—especially Britain—have become the leaders of civilisation, that farming and farm implements have been developed and improved. With a fertile soil and a warm climate, where it is only necessary to tickle the soil to make it smile into a harvest, improvement in tillage is unnecessary; while the warmth renders a small quantity of food needful, and clothing may be reduced to the lowest denomination. As food and clothing are the only two things the untutored mind and body desire, stagnation was inevitable under such circumstances.

Grant Allen's African mother, who can raise as many yams on a rood or two of land, by the use of a hand-hoe only, as will feed her family of ten without any help from the fathers of the tribe, is not likely to require an American chill-plough; while the chronic state of warfare among even advanced races has acted still further against improvement.

The stubborn soil and ungenial climate of northern regions has aided in the advance of agriculture in two ways: first, in developing races of men of a robust, self-reliant nature, who could make the most of everything within reach; and secondly, by making it more difficult, if not impossible, to produce a crop in the easy slipshod way of tropical and subtropical regions. The Romans, indeed, were splendid farmers considering their opportunities, and much of the information and advice given by such writers as Virgil, Columella, and others, might be taken to heart by farmers of to-day,—such things as deep cultivation and rotations, and even draining, being understood by them. Their implements, however, were of excessively rude construction, and the farming conducted on a very small scale. The story has often been told of Cincinnatus, who, when called to assume the dictatorship, was found by the delegates following the plough. This story looks well, but as his farm did not exceed 3½ imperial acres, and as his plough could only be the crooked branch of a tree dragged by oxen, and making a rough rut in the ground, the whole establishment did not amount to what a profane American would call a "one-horse affair."

The chief end of man in those days was to gather gear at the point of the sword, like Rob Roy, and there was little wonder that arable farming did not improve when a man might sow a crop but could not tell who would reap it. The beasts of the chase and roving flocks and herds sufficed until men became thicker on the soil, and settled down and married respectably, or married first, and were then settled.

THE PLOUGH.

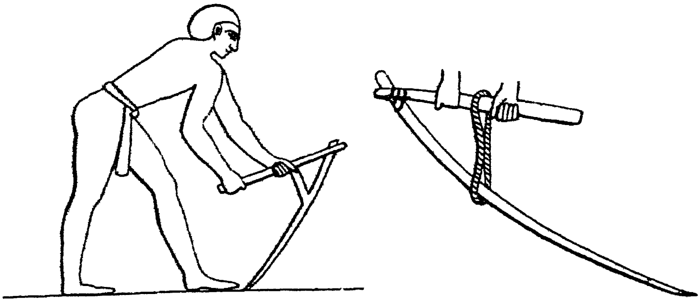
Coming to the implements, the most important in modern tillage is of course the plough, and I naturally take up this first in the following brief sketch.

The plough, as we know it—that is, as a tool for turning over a furrow-slice—is of comparatively recent evolution, however, and was preceded for many ages by the use of a manual tool resembling a sort of large hoe or pick. To this the Romans gave the name of *sarcle* (figs. 1 and 2), and it is in common use in many regions to this day. The illustrations of the *sarcle*

in figs. 1 and 2 are reproduced from C. Wren Hoskyns' 'History of Agriculture,' published by Messrs Bradbury & Evans, London, from which work figs. 3 and 4 are also taken. Fig. 5 is from Philp's 'History of Progress in Britain,' published by Messrs Houlston & Sons, London.

The late Chandos Wren Hoskyns found it at Cadiz, where the population is descended from early Phœnician colonists, and emigrants from these again have carried it to Madeira, Brazil, and the West Indies.

Jethro Tull was of opinion that men must have got the first idea of cultivation from the rooting of their hogs. Antediluvian swine had enormously long snouts—as have had a good many swine since the days of Noah—and prehistoric man noticed that where the pigs rooted around, there seeds afterwards sprouted and grew best. As he was a reasoning being, notwithstanding the brachycephalic shape of his skull and the



Figs. 1 and 2.—Egyptian Sarcle.

thickness thereof, he thought that if he were to proggle the soil with a stick and plant seed, the same result would follow; and in this way arable farming began. The *sarcle* was an improved form of stick, used exactly like a pick, and most efficiently it broke up and pulverised the soil, the trampling doing no harm in a dry climate. Work with it, however, could only be done on a small scale, so that it only suited the regions where the soil and climate were of the best, and where a sparse peasantry were satisfied with a few roods of land sufficient to find food for them and their families. When, however, men became ambitious to hold more than a whole acre of land, and wanted—let us say, for the sake of illustration—the historic three, it became necessary to find some way of working the *sarcle* with less expenditure of sweat, and in a more expeditious manner.

Some genius, therefore, hit on the plan of lengthening the handle of his pick or *sarcle*, and yoking his cow or ox (or two of them)

thereto, and making them drag the digging-point along through the ground. For the purpose of keeping the implement steadily in the soil, one or two handles were fitted on to the heel or angle of the implement, and thus became evolved the FIRST PLOUGH (figs. 3 and 4).

Material of the First Plough.—The material was undoubtedly the forked branch of a tree, cut to the size and form desired, but the man who first fashioned it thus would be treated by his neighbouring farmers as an amiable lunatic on account of his new-fangled notions, if we may judge by what has happened in the twenty-four centuries which have elapsed since the art of writing was first invented. He probably would not make his farm pay, but he served mankind better than the greatest of generals have done; and, notwithstanding his probable want of financial success, yet his innovation "caught on," and in the later monuments we see the two-handled plough pulled by two oxen, said oxen being stimulated and directed by the use of a goad. At the best, however, a plough of this description could only tear out a jagged rut along the ground into which the seed was dropped, the crop being kept clean by much hand-hoeing, a part of the land being bare fallowed each year; and it is not until we come down to later Saxon times in our own country that we find any attempt to make a mould-board or wrest which turned over all the torn-up or cut-out soil to one side.

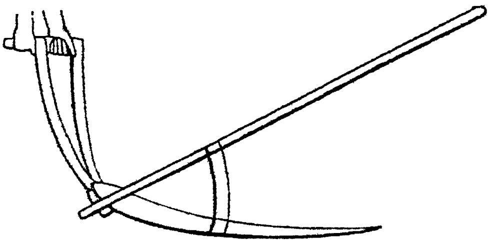


Fig. 3.—Ancient Egyptian Plough.

Early Saxon Ploughs.—The earlier Saxon ploughs (fig. 5)—and indeed Eastern ploughs at the present day—turned over a kind of furrow in a sort of way. The cutting part was formed like a round-mouthed shovel—there being no coulter—and by tilting over the plough to one side the strip of soil pared off was turned over. Reversing at the land's end, and tilting the plough over to the other side, enabled the ploughman to plough back in the same furrow, after the manner of our turn-wrest ploughs of to-day. But even this elementary improvement penetrated into remote parts very slowly.

In our own days in the Western islands there was in use—and may be yet—a form of plough known as the *caschrom*, which was simply the branch of a tree sharpened at one end and shod with iron, and used merely to make a rut for the seed,

being either pushed by the workman and guided by him, or pulled by horses or women attached at the other end; so we are not so highly developed as we thought after all. The *caschrom*

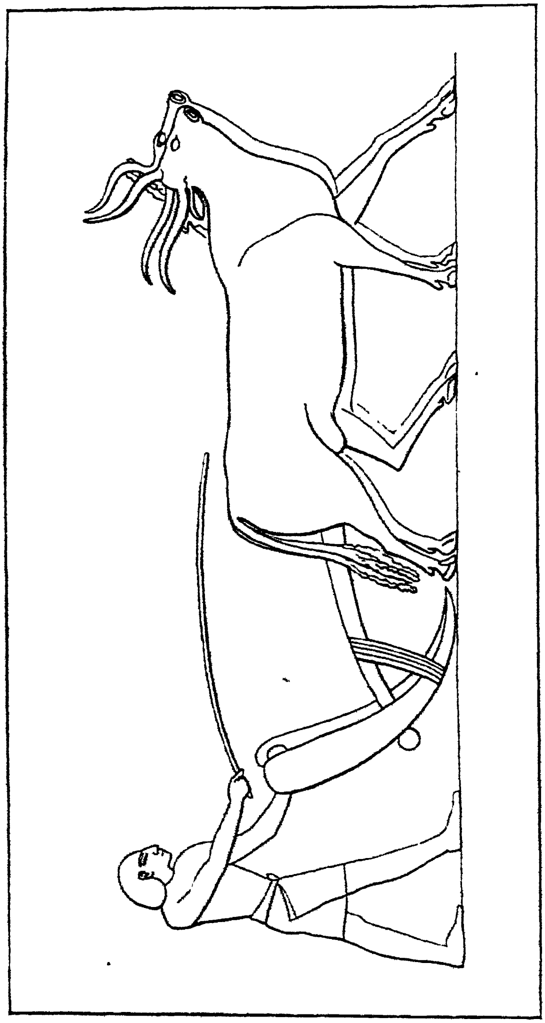


Fig. 4.—Ancient Egyptian Plough at work.

is shown in fig. 6, taken from the first edition of the 'Book of the Farm.'

It took a thousand years, or more, to develop the Saxon plough into a resemblance of the typical implements one now sees in the show-yards, and seldom sees on the farms. And I have talked with men yet living who remember in the days of

their boyhood that there were no iron ploughs, but that they had only home-made articles chopped out of the forked stem or branch of a tree, with the wearing and cutting parts only covered with plates of iron.

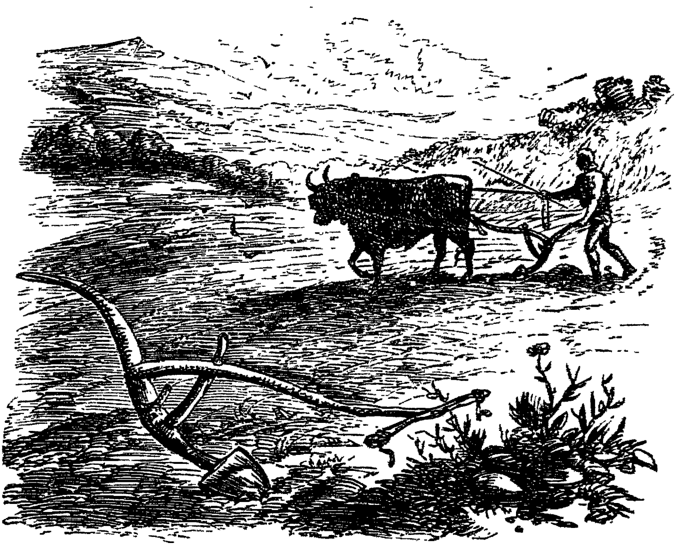


Fig. 5.—Early Saxon Plough.

Dutch Ploughs.—About the middle of last century the Dutch or Rotherham plough was introduced, and it is only in this form that we begin to approximate to the shape, size, and arrange-

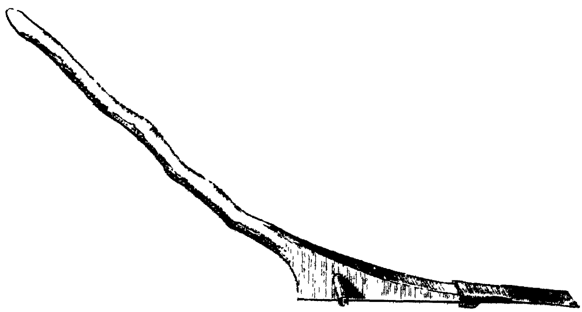


Fig. 6.—Caschrom.

ment of the parts of a modern plough. I have in my possession a 'General Dictionary of Husbandry,' published in 1766, in which this plough is figured and minutely described. It is easy to see that our modern ploughs are only improved modifi-

cations of this form—the chill-plough indeed being wonderfully like it.

Stephens in the 'Book of the Farm' (first edition) states that this plough was introduced into Scotland—that is, into the Lothians—as early as the middle of last century. But until James Small took up the subject, and by his judicious improvements gave a decided character to it, little or no progress had been made with it. Small brought out his plough about the end of last century, giving the mould-board and share a form which could be imitated correctly by others, and thus the number of improved forms multiplied. The mould-board in his time was literally a board covered with plates of iron, the casting of this part from a fixed pattern being a later improvement.

Small's and Wilkie's Ploughs.—At a later period Wilkie of Uddingstone introduced a new form, and Small's and Wilkie's ploughs became the types for all ploughs made in Scotland down to very recent years—the former in the east and the latter in the west country. The chief difference between the two consisted in the mould-board: in Small's form it was concave like an American chill—in Wilkie's, convex. They were

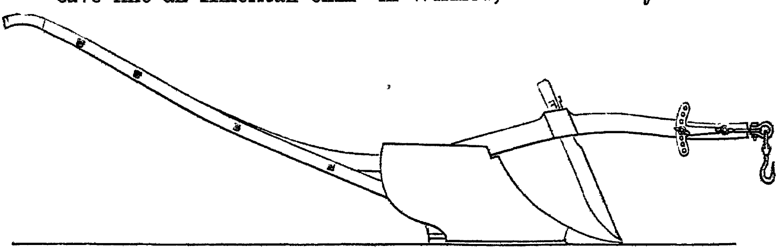


Fig. 7.—Small's Plough.

named respectively the East Lothian and the Lanarkshire ploughs, and in the form of all-iron ploughs were gradually introduced into other districts. Small's plough is represented in fig. 7, taken from the 'Book of the Farm.'

Spread of Iron Ploughs.—The introduction of these ploughs depended much on circumstances; as one instance I may relate the following. My grandfather, Primrose M'Connell of Dailly, Ayrshire, was a country blacksmith and farmer. When a lad in the end of last century he went to Edinburgh as an "improver," and there got acquainted with the new ploughs. Returning home with the patterns, he took the earliest opportunity of having one made and worked on his own farm, and persuaded a neighbour to use it and compete at a ploughing-match with it. The new plough enabled the man who held it to win the first prize; and the assembled farmers were so satisfied that it was a good thing, that my ancestor had as many orders thrust

on him in that one day as kept him busy making ploughs for the next three years. He kept on at it and continued making up till the year 1837, and estimated that he must have manufactured about 3000 altogether—not a bad turn-out for a country "smiddy." Thus was the iron plough introduced into Carrick.

Improved Ploughs.—The style of the ploughs continued very much the same—with the exception of the introduction of that abomination known as the "high-cut" share—until a few years ago, when the introduction of the chilled plough from America, with its many modifications, quite upset all our previous ideas on the matter. The rapid adoption of these improved forms by farmers tends to show that some of them at least are, strange as it may appear, moving with the times—though it would not be difficult to find districts in which there has been little advance yet on the plough of Jethro Tull, or even of two hundred years ago.

It may be said with a great amount of truth that, until the introduction of the *chill forms*, the plough could scarcely be called a *tillage implement* at all; it only cut and turned over a furrow on which tillage implements such as harrows and cultivators could work, these latter doing the real cultivation.

The chilling process was no new thing, for Messrs Ransome claim that the founder of their firm chilled his cast-iron ploughshares as early as 1803; but the adoption of steel mould-boards, and the chilling of the same so as to produce an unequalled hardness and polish on the working side, was a new advance, which has been eminently successful.

Jethro Tull in the first half of last century endeavoured to remedy the want of cultivating power by having a plough fitted with four coulters in such a way that the turf of the furrow-slice was cut into strips, and this when turned over caused it to break up easily, this plough being figured and described in his book on 'Horse-Hoeing Husbandry.'

Form of Furrow.—The shape and size of the furrow-slice is a matter round which many a battle has been fought, and probably many more are yet to come. The bulk of the arguments, as far as I can see, are in favour of a rectangular cut 10 inches wide and 7 inches deep, or in the same proportions where two horses can only pull a lesser size; and also that a raised feather on the share is a mistake, because, though it makes a crested furrow, yet it is "false-bottomed," and has not the amount of soil moved up and exposed to the weather which might be.

It is, moreover, quite possible, by setting the coulter at a slight angle, to have the furrow a little "crested" while keeping the bottom level. Professor Malden, in his book on 'Tillage and Implements,' says that the three types of furrows given in

Messrs Howard's catalogue are the only good ones, and that all others are bad. He says: "One well-known book on agriculture illustrates and commends an impossible furrow, which, while being cut out with a level sole, has the coulter so set that it is at very much less than a right angle to the sole. We should pity the ploughman who had to hold a plough set in that position." I do not know if this quotation is intended for me or not, but as the cap fits me I proceed to put it on. In the first edition of the 'Book of the Farm,' published in 1842, Stephens describes the Lanarkshire plough, and illustrates it very minutely. Regarding the coulter he says: "By reason of the bend in the beam to the right, and the point being to the left of the land-side, it stands very *oblique*." This plough, as already noted, is the type in use over the whole of south-western Scotland, and in my own experience I would say nine out of every ten ploughs I have seen there were so made and set. If, therefore, this furrow is impossible, or the work uncomfortable, how did we western Scots not find it out long ago? In actual work it does not matter whether the cresting is made by the coulter or the share, though if made by the former there is more soil brought up. But if the land is to be harrowed for a drill to work, there is no need of the cresting at all.

Mechanics of Tillage Implements.

In the short sketch given above it will be seen that the development of the plough has been a very slow process—a period of at least seven thousand years having elapsed since the earth was first scratched with a forked stick, until now, when we have all manner of modification of iron and steel implements.

Now mankind had found out from practical experience at a very early stage certain of the mechanical laws and conditions of work, long before mathematicians and other learned men had worked out the reasons for those laws and conditions; but when improvement becomes more intensive and more particular and advanced, the mechanic and the engineer find it beneficial to call in the aid of a knowledge of the theory and science of their craft, and we have long arrived at that point in the designing and making of ploughs and other farming implements. I purpose, therefore, devoting a few paragraphs to a short statement of the mechanical principles on which implements are made and do their work.

Mechanical Powers.—All machinery, however complicated, is compounded of two or more simple elementary machines known as the "mechanical powers," usually reckoned six in number,

and known as the lever, inclined-plane, screw, wedge, pulley, and wheel-and-axle. In the modern plough we have the most of these combined in one, and a consideration of these will explain the mode of handling this implement. The modern English and Scotch ploughs are represented in figs. 8 and 9 respectively.

The handles and "stilts" comprise a lever, and as every one knows that a long-armed lever gives the most "purchase," so the stilts should be as long as possible consistent with proper control of the horses and convenient turning at the land's end. They are usually made about 6 feet in ordinary ploughs, but I have seen a plough exhibited at the Colonial Exhibition in London, by the Ballarat (Australia) Agricultural and Pastoral Society, with stilts 10 feet long—the total length of the implement being 15 feet.

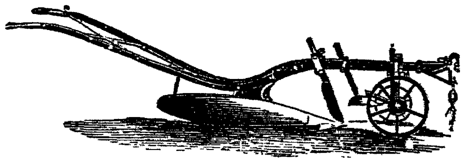


Fig. 8.—Ransome's Modern Plough.

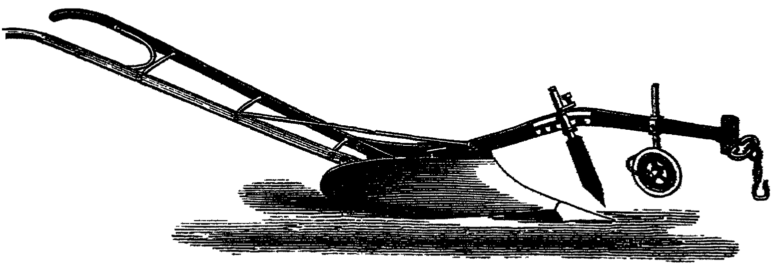


Fig. 9.—Sellar's Modern Plough.

The shortness of the handles in chill-ploughs I shall have occasion to note later on.

The *working parts* of a plough—that is, the coulter, share, wrest, cheek, and sole—looked at collectively, form a wedge, and the mould-board is also partly an inclined plane and a screw. Without going into mathematical calculations to prove it, it may be taken as a matter of common experience that a long thin wedge will penetrate any substance more easily than a thick short one, and that, therefore, the longer the body of the plough the more easily will it be pulled through the soil. The same rule applies in the case of the inclined plane, so that the wrest should also be as long as possible; for convenience of handling, however, a mould-board of 30 to 36 inches has been adopted,

though in the Ballarat plough above mentioned this was 5 feet long, and 4-feet ones are in common use in this country.

The application of the *wheel* to ploughs is a great improvement. The wheel is practically a series of levers (the spokes) arranged round a common centre, and the larger it is the more easily is it turned, so long as its own weight or thickness does not interfere too much with its usefulness; and we see the idea of large wheels carried out on the American sulky or gang ploughs. This is an old invention revived, however, for the old wooden ploughs of last century had wheels in front, sometimes almost as large as cart-wheels, and never less than 20 in diameter, and fixed on a separate frame in front of the beam. The modern ploughman became so exceedingly smart, however, that he disdained the use of wheels, and would work only with the swing-plough. Wheels thus dropped into disuse, especially on stony or rocky ground, where they do not always work well. Their value for making steady even work, for regulating the use of the skim-coulter, and for ease to both men and horses, is becoming again recognised, and wheels are now coming more and more into use.

So far the rules of mechanics govern the form and construction of the plough as an implement for cutting out and turning over a furrow-slice in the easiest manner; but there are certain other considerations which have come to the front in recent years.

Working of Chill-Ploughs.—I have already mentioned that the plough in its ordinary form, in which a furrow-slice is cut and turned over more or less unbroken, and in which the parts are all shaped and fitted to do this with the least expenditure of force by either man or horse, is not, properly speaking, a tillage implement; and it has fallen to the lot of our sharp cousins across the Atlantic to convert the plough in such a way as both to plough and cultivate at one operation (fig. 10). This is all done, practically, by putting on a short breast and setting it out at a pretty obtuse angle. Further, this breast is made wholly concave, whereas in the ordinary plough the twist of the mould-board is more or less convex. The result of this is, that in passing through the soil the furrow-slice is as it were bent on itself and crumbled by

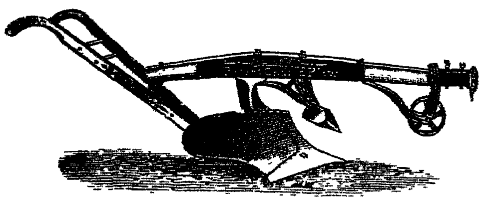


Fig. 10.—Oliver's Chilled Plough.

the wide-set breast, thus turning over and reducing the soil to a good tilth at one operation.

Now this plough is constructed contrary to the rules of mechanics mentioned before, in that it has short handles, giving little leverage power, while the mould-board is wide-set, and thus, like a thick wedge, requiring more power to force through the material to be divided; and it may naturally be asked how so many farmers find them so efficient and easy to handle.

There are four reasons for this that I know of, and perhaps there may be more. First, the implement itself is very light and easily handled; secondly, the cutting edges are made much sharper than is common with ordinary ploughs; thirdly, they are always, in this country, provided with at least one and sometimes two wheels; and lastly, the material of the wearing surfaces is a variety of chilled cast-steel which, I am informed, cannot be made in this country, and which takes on so excessively fine a polish as to materially reduce the friction—in fact, reduces it so much on some soils that the total draught exerted by the horses is only a fraction of that required for ordinary ploughs.

Chill-Ploughs on Clay Land.—But notwithstanding all these advantages, they will not work on every soil—a result to be expected from the infringement of mechanical laws; and my own experience with them on the stiff Essex clay is that they are more or less a failure. I have had an opportunity of trying a "haud" with them on light soils, and they worked to perfection; I have also had an opportunity of trying them on the magnificent black loam of the Western prairies, and the rich brown but rocky loam of the backwoods of New England, in all of which places they worked admirably. At home I have had three or four varieties of them on trial, and neither I nor my best ploughman—who won first prize at our local ploughing-match—could do anything with them. Not to be beaten, I purchased a dynamo-meter for the purpose of testing the draught, and found that there was no appreciable difference between them and the common plough at the same width and depth of furrow. The wheel prevents them from going deeper than they are set; but they are so light in themselves, and so short in the handles, that they scoot up or sideways anyhow before you can do anything to counteract this. They would no doubt go better if they had two or more wheels, or were set in a sulky frame, so that the body would be held rigidly in the proper position, and not require to be held by a man at the end of a too short lever.

But if the difficulty about draught and holding the stilts were overcome, there still remains the fact that they do not

perform their cultivating work properly in clay soils, for the simple reason that clay will not pulverise, especially if it is wet. In my case the furrows were turned over in wide flat slabs and laid in all angles and directions. The mechanical difficulty of holding the plough comfortably could be overcome, possibly by only two wheels on the beam; but clay will not pulverise like loam, unless it is dry, and then it is too hard for easy work.

The light-land farmer may therefore buy one with a light heart, but let the heavy-land man profit by my experience and have one on trial first, and with at least two wheels on it.

Ploughing and Cultivating.—The chill-plough has been brought out for the purpose of converting ploughing into cultivating, but soils that do not readily lend themselves to cultivation may or may not work well with it. It is a matter of degree: the common ploughs made by all the leading makers in this country have been designed to enable a furrow-slice to be cut and turned over with the least expenditure of force.[1] The chill-plough has been designed to work in a contrary sort of way—that is, to crush up and pulverise the slice after cutting out, so that while its four good points enumerated above do more than counteract its evil ones, yet its efficiency varies as the soil is light or heavy, and on the latter it may not work at all, as in my case.

Wearing Parts of the Plough.—I may at this point introduce a few statements regarding the subject of friction on the wearing parts of a plough in work. There seems to me to be an entire misconception on this matter in the minds of many, for I find in two books treating of farm implements, and in many implement-makers' catalogues, statements which are the exact opposite of those taught by such authorities as Todhunter, Twisden, Balfour Stewart, Goodeve, and others whose text-books I have on my shelves. I do not mean that these mighty men would tackle such a common article as a plough, but the principles they enunciate, when applied to the plough, are contrary to those taught by many writers on this useful implement,—writers who assert that the short mould-board has less friction than the long one.

The *laws of friction* are: (1) Friction is proportionate to the pressure between two surfaces. (2) Amount of friction is independent of amount of surface in contact. (3) Friction is independent of velocity.

Applying this to the plough, it follows that, (1) as the short wide-set mould-board (on the principle of the inclined plane or wedge) has the most resistance to its passage through the soil, therefore the friction is greater, and (2) that the lesser extent

[1] One maker informed me that the curve of his wrest had been calculated for him by a Senior Wrangler.

of the surfaces in contact—*i.e.*, mould-board, cheek, and sole—do not lessen the friction any at all.

If this is not the legitimate application of those rules, I shall be thankful to have some one set me right.

Now as it is especially claimed for chilled ploughs that because they are short therefore the friction is less, and as on some soils it is found to be less by actual test, the reader will naturally want some explanation. I have already given three or four reasons to account for this, and may remark in passing that I do not remember any authoritative trials of wide extent to prove the ease of draught of the chill-plough, though there have been numerous private trials. My own trials with the dynamo-meter showed no superiority in this respect over even the Essex wooden plough. I think much depends on the kind of plough tried against the new incomers. There is, however, another matter to be noted in this connection, and that is the adhesiveness of the soil. There are some soils so adhesive that the mould-board has to be lubricated with water to keep the furrow-slice from sticking to it; and I have seen an apparatus for this purpose, though whether the plan is now followed or not I cannot tell. This is outside the question of pressure, but possibly the friction may be increased by this on a long mould-board. I cannot see, however, that there would be much difference on ordinary workable soils.

Digging-Ploughs.—The demand for ploughs which shall not cut its furrow-slices like so many bars of soap and squeeze them so that they remain unworkable until loosened up by the rain and frost, but shall thoroughly cultivate to a good depth, has led to the development of what is known as the "digging" plough (fig. 11). I cannot too highly praise this tool. It bids fair to become of more value than its parent in modifying our ideas and practices of tillage. It is modelled after the chill-plough, but made larger and stronger, while the knife tail-piece still further divides the furrow after turning. It has been a matter of surprise to me to find that on the same field, and the same part of the field, this plough does such satisfactory work, where the American chill failed.

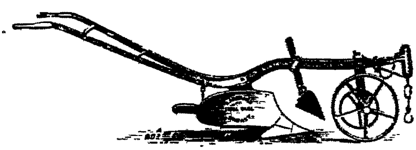


Fig. 11.—Ransome's Digging-Plough.

To show how well this digging-plough works, I may relate that this autumn a 20-acre field at home was to be ploughed across the old ridges. After the long dry summer the clay was baked as hard as macadam, and it was very difficult to get a plough to go deep into the soil at all. We set it to 8 inches

deep, however, and 12 wide, put four horses in—two and two—and ripped it up to my entire satisfaction. But this is not all: the dryness of the earth enabled the pulverising action to be carried out most admirably, and after finishing, the ordinary plough was brought out and the land drilled up straight away for next year's root crops, thus saving all the usual work of harrowing and cultivating in spring.

It would, of course, be impossible to hold a digging-plough if there were no wheels on it. The wheels keep it steady to the regular depth and width, while the skim-coulter turns in all weeds and rubbish to the bottom. The skim-coulter is indeed one of the most prominent features about this plough, as it is made unusually large, and is set so as to pare off the most of the top part of the soil. All weeds and rubbish, therefore, are thrown into the bottom of a deep furrow, and a good thickness of clean earth turned up on to the top and spread over it. In a heavy soil it means that the weeds are smothered out if the furrow has been deep enough, and in a loamy soil that they are considerably checked.

The digging-plough has now been converted into a most efficient tillage implement, the best indeed in existence; and further developments in this line may possibly make it still better.

Harrows.

I now take up the harrow next in order. There is not much to say about this implement, and this little must be of a depreciatory nature.

Ancient Harrows.—The harrow never was invented, at least such was the dictum of the late Mr Hoskyns in his 'History of Agriculture.' The first man who grew enough of corn to need some tool for the purpose of covering in the seed used the branch of a tree—the bushiest and with the most angular twigs he could find; and when he needed to call in the services of his most long-suffering ox, he spliced the thick end of the branch to the animal's tail, thus adopting an exceedingly convenient arrangement whereby saddler's bills were dispensed with.

Later on horses were pressed into service in the same fashion for all kinds of work; and the Irish Parliament, as early as 1634, passed an "Act against Plowing by the Tayle, and Pulling the Wool of Living Sheep." Moreover, in certain remote and unexplored regions, vaguely known as the Western Hebrides, it is believed that both these customs were in vogue much later than the time of our grandsires.

Modern Harrows.—The transition from the branch of a tree to an artificially made frame with wooden pegs or teeth may

have occurred pretty early in history, but, like the civilisation of the Chinese, the development must have been arrested a very long time ago. I say this because I have myself seen wooden harrows with wooden tines, while, when I was a boy, wooden frames with iron teeth were the rule. Now iron frames and iron teeth are almost universal, made of various degrees of efficiency and inefficiency—chiefly the latter.

This last statement is no doubt a hard saying, but it is true. If any one who has given some attention to the study of engineering, and knows something about the strength of material, rigidity of structures, strains, stress, and so on,—who knows something of the mechanic's art, and who has plodded behind all sorts of harrows for many seed-times, and has seen these harrows succumb in all kinds of ways before his eyes, and thus knows their weak points, and then goes round the stands at some of the big shows, he must be struck with the want of proper design in a large proportion of those exhibited.

The diagrams in the catalogues show carefully that when properly yoked, so that they "hang" right, every tine follows a line of its own: this is all right and proper, though even in this respect I have found some that would not go thus, yoke them as you will, because the tines were not pointed properly, of which more anon. But there are a great many other things to be attended to besides this. Engineers have long ago found out that in all structures the framework is much stronger and more rigid if it is made of angle, tee, or channelled iron, or even of pipes, than if the same amount of metal were made into solid, square, or round rods or pillars—and conversely, that the same strength may be given by a lighter framework if the material is properly placed; also that a thin flat piece is many times stronger when set on edge than when laid flat, as in floor-joists and in bridge-girders.

Now applying this to the harrow, we can see that those with frames made of angle, tee, or other iron have one point in their favour, while those of square iron have one point against them.

The next most serious matter is the shape of the tine, and the method of fastening it to the frame. The square tine is an error: the same amount of iron, hammered flat and set edgeways, will give double the strength, and the thinner edge will give greater penetrating and cutting power; also, if the tine is properly set it will keep the whole implement going in the proper direction, so that each tine cuts a different course—a result that does not always happen with square teeth. The curving forward of the point of the tooth is a question depending on circumstances. Light harrows with curved teeth will penetrate as deeply as heavy harrows with straight teeth, but the curve is a little more apt to gather rubbish in front. On the

whole, however, a slight curve is desirable, while in practice I have not found even a considerable curve objectionable.

Now the fastening of the tine on to the frame is to be considered, and it is a matter of some importance, if we may judge from the number of patents taken out and the innumerable designs to be met with.

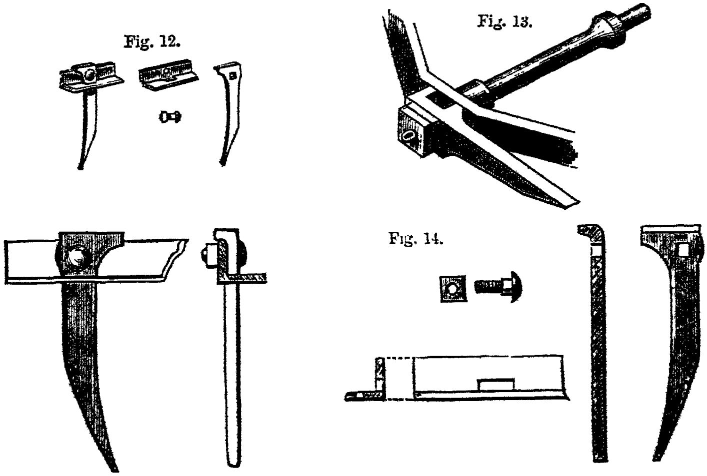
The style in which each tine has a smaller neck on the top, screwed for a nut, and with a square-cut shoulder, may be condemned at once, though many makers still turn them out. I was a student in engineering under the late Professor Fleeming Jenkin at Edinburgh, and I remember him demonstrating the mathematical reasons against having square cut-out corners when a thick and a thin piece of iron were joined together, and also giving the mechanical proof from the "grain" of the iron being cut through, thus weakening it. His remarks were made in connection with the designing of links for suspension bridges; but as I had been following the harrows the spring before, and expected to be doing so the spring after, I took note of this, as being the explanation why the tines of my harrows were everlastingly snapping at the necks. I may as well here confess, however, that I have been betrayed into buying harrows with the same defect since, because, notwithstanding all I know about these matters, I am not a match for the ordinary implement agent, who treats me as the New Testament commands that we should treat strangers.

Recollecting the fact that the tooth of a harrow in meeting obstructions or resistances in passing through the soil is being acted on as a lever, and that a strain or shock at the point requires double or triple strength at the neck or fastening to withstand it, we can understand why it is that the tine must be made thick and strong where it is fixed to the frame instead of smaller and weaker.

As this is a matter of some importance, and the rule applies equally well to all cultivating implements, I think it desirable to go into it a little more fully—the more so as, to judge from the illustrations in a pile of catalogues now before me, there are eminent firms which continue to make them in an objectionable fashion. If the teeth are made thick enough and heavy enough, they will, of course, stand all ordinary tear and wear, even if of an inferior design; but the point is that, if properly designed, they may be made much lighter and possibly stronger. It may be laid down as an axiom that a harrow or cultivator tine should never break at the neck or fastening, unless there be an accidental flaw in the metal,—but that if the shock or strain is too great, it should give way at the point or up the stalk a little. The majority of farmers probably look on the breaking at the neck as an unavoidable incident—part of the accepted tear and

wear; and thus the makers are not pressed to improve, while those who do adopt a proper design are not properly encouraged. As an example of good designs, I select the first three which come to hand. Figs. 12 and 14, by Messrs Ben Reid & Co., of Aberdeen, and W. G. Murray & Co., Banff, respectively, showing in addition an angle iron frame; fig. 13, by Messrs Larkworthy & Co., Worcester, showing a thin flat tine, set edge on.

I am sorry that I cannot say a good word for the flexible form of harrows. They were designed to rise and fall in work in such a way as to suit the inequalities of the ground; but as one of the objects of harrowing is to level down inequalities, I look on this as a point against them. A worse fault, however, is the constant wearing loose of the joints, which allows the



Figs. 12, 13, and 14.—Improved Harrow-teeth.

whole frame to pull out more or less straight, and thus destroys the zigzag form necessary to give each tine a course for itself.

Disc Harrow.—I have previously remarked that up to our own time the harrow has received very little improvement in its general principles. It was and is simply a frame fitted with teeth or pegs—improvements being made only in details.

But about the year 1857 a farmer in America, named Mr Nishwitz, bethought him that some other form of harrow or cultivator might do the work more efficiently. He accordingly set to work to invent something new, and brought out what is now known as the "disc" harrow (fig. 15), which is in common use to the present time as a pulveriser of freshly broken-up prairie sod.

The "disc" harrow is only in limited use in this country, and

is quite unsuitable for stony or rocky land; but it does splendid work "out West"; while a modification of it I have seen is still better, and consists in having each disc with parts cut out of its edge, so that from four to six radiating arms are left. The objection to this implement is that it tends to gather the earth up in ridges, as the two sets of discs must be set at an angle to each other.

Acme Harrow.—Mr Nishwitz, however, was not satisfied with the disc harrow, and kept working away until he brought out what is known as the "Acme," a Greek word which may be freely translated to mean "tiptop." The illustration (fig. 16) will explain the appearance of the acme harrow to those who have

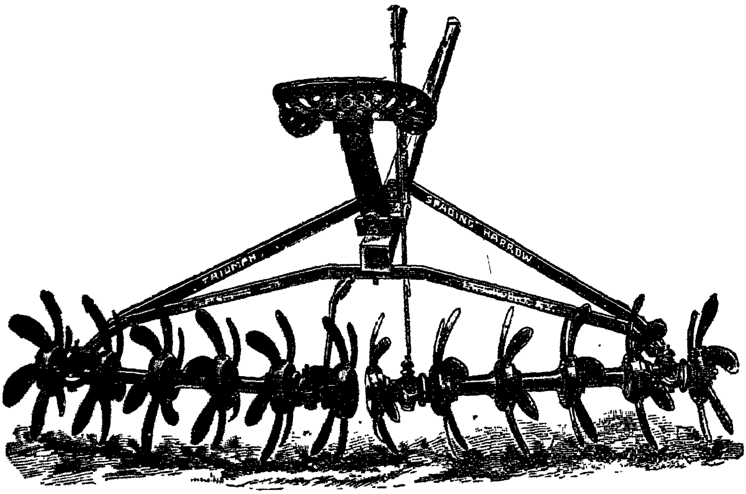


Fig. 15.—Disc Harrow.

noticed it at shows or have used it, for I must confess I could not understand what it was like from the picture until I had actually seen the implement.

I have used one of the older forms of the acme harrow for some six or seven years now, and have never seen anything like the work it produces in making a seed-bed and preparing the land for the corn-drill. Without exaggeration, I have seen it do more good going once over the land than the heavy two-horse harrows did in four strokes.

This harrow is a frame set with curved thin steel knives, which cut through the soil instead of tearing through it, and thus cover in rather than turn up the surface. The draw-back is that they will only work crossways to the lines of ploughing—at least on lea-land; for in going up and down

the blades are apt to slide in the furrows without doing any good.

In light or easily pulverised land they may do no better than ordinary harrows, but on heavier soils there is nothing I know

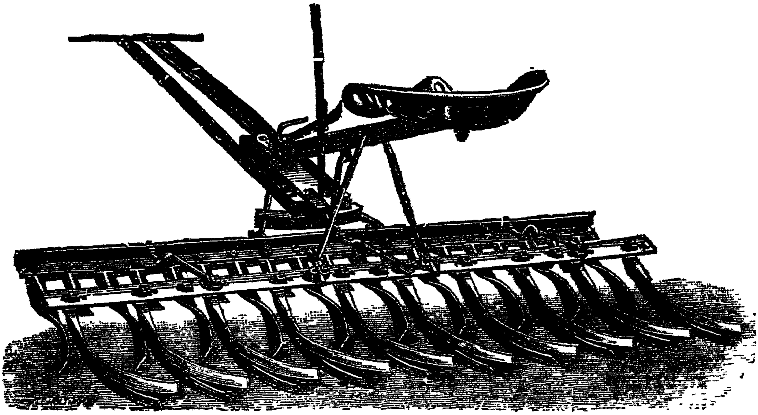


Fig. 16.—Acme Harrow.

to equal them. I have used it over several hundreds of acres, putting it only once across the ploughed land in front of the corn-drill, though twice is better. In the spring of 1893 we were beaten to use it, however, as the dry weather came so

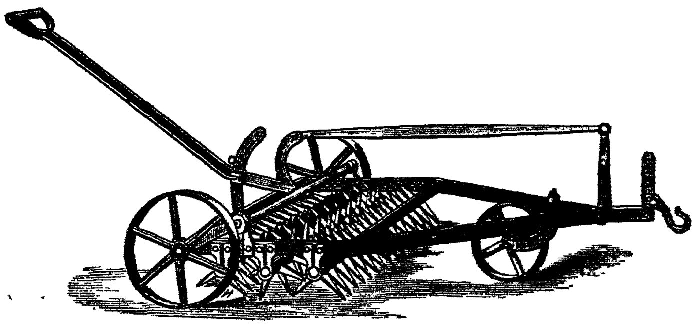


Fig. 17.—Norwegian Harrow.

suddenly and sharply as to make the soil set like cement; and it was only by repeated harrowings with the common implement that enough clods could be got to cover the seed.

The Norwegian Harrow.—The Norwegian harrow (fig. 17 [1]), which may be likened to a framework full of revolving spurs, is

[1] 'The Book of the Farm,' fourth edition. William Blackwood & Sons.

very heavy in draught, but it does exceedingly good work as a pulveriser of cloddy soil. On land where all ordinary harrows fail to make an impression in getting a friable mould, this implement will have the desired effect, the spikes penetrating and splitting up the hard-baked lumps.

On the principle that the larger the wheel the more easily turned it is, the spiked segments ought to be as large as convenient consistent with light weight, while the ordinary wheels which carry the whole may be made of the usual size, though they are generally much smaller than they might be with advantage. As a whole, however, the implement is so efficient for preparing land for fallow crops, that it is worth the while of heavy-land farmers to consider if they would not be better served with this implement than with a clod-crusher.

I have long held the opinion that land which requires the latter ponderous implement to pulverise it would be much better not cultivated at all, but laid away in permanent grass. Anyhow, if the Norwegian harrow will not work it efficiently and enough, it is a very bad case. This implement is generally made to take 5 feet wide, and requires three horses to pull it comfortably.

Bush-Harrow.—The bush-harrow still exists—though it was the earliest form ever adopted—and is largely used in some districts. At one time a hurdle or flaik was filled with branches—thorn in preference,—but now a regular framework running on two wheels is adopted. There is a difference of opinion as to the value of the work done with this rough-and-ready arrangement. Some farmers run it over their meadows every spring, presumably to spread the worm-casts and ruffle out the dead grass — operations much better done with the chain-harrow. Others again use them for putting in grass-seed, apparently quite unconscious of the poor chance they are thus giving to the grass. Even seedsmen direct that grass-seed should be "brushed in," apparently thinking that the lighter the seed is covered the better. As has been proved by test-trial and ordinary experience, grass and clover seed should be put in at least half an inch deep, and three-quarters is better. Indeed, even the common "grass-seed harrows" are too light for this work, and fairly heavy ones should be employed.

Chain-Harrow.—For efficiency in its own particular work, however, the bush-harrow has long been eclipsed by the chain-harrow (fig. 18). Many patterns of link have been adopted, but as far as my experience goes the first and oldest form is still the best—*i.e.*, the square malleable iron link. I have had an opportunity of trying and seeing tried some other forms which were considered improvements, but I found that the links tended to choke up with the rubbish, while the whole rubbed and pressed

over the soil or grass without shaking it up and spreading and mixing as one would like.

On the other hand, when there is a lot of rubbish, such as straw, among the manure spread on the surface, nothing beats the square link for spreading the fine particles of the dressing, and at the same time rolling up the strawy portions so as to enable them to be easily picked up. To the buyers of harrows

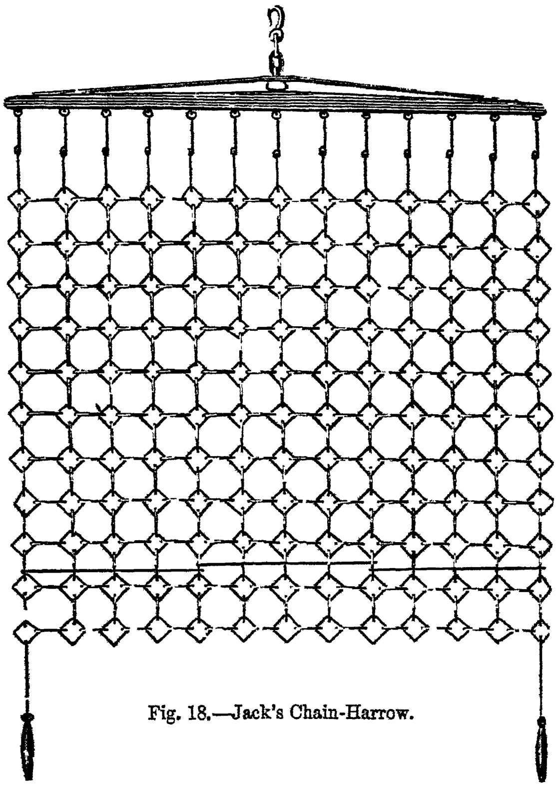


Fig. 18.—Jack's Chain-Harrow.

of this kind, as to the wearers of watches, I would say, beware of fancy chains.

Wheels on Harrows.—The question of putting wheels on harrows may be dismissed in a few words. There is no doubt of the value of wheels for regulating depth and for carrying weight, and if they could be conveniently fitted on they would no doubt be an improvement on all except the cloddiest soils. Wheels cannot be conveniently put on, however, for the reason that a set of harrows is usually made in divisions or "leaves,"

from three to five in number, and it would make these clumsy and complicated to fit on wheels, with the necessary frame for raising and lowering. Besides, the gain would be infinitesimal; for harrows tend to keep near the surface in working, and spread over so great a width in proportion to depth that they keep pretty level and steady.

When, however, we come to the case of acmes, drag-harrows, cultivators, grubbers, scarifiers, horse-hoes, and all this genus—implements which are really magnified and modified harrows—the circumstances are quite altered, and wheels are a necessity, as will be shown later on.

Cultivators.

And now I deal with the great army of cultivators—the tillage implements properly so called—and expound their philosophy as it appears to me. The forms and kinds of these implements are numberless, due to the varieties of soils intended to be cultivated, the varieties of crops to be raised, and the varieties of men who invented and handled them. It is impossible that I should treat of all kinds, as that would include many I have not seen and know nothing about. But it is not necessary to do this, as those ordinarily used in preparing ploughed land for a root crop will serve as very good examples of the general body.

Form of Tine.—What I said about harrows, regarding the structure and arrangement of the framework, the fixing on of the tines, &c., applies equally well here, but something more must be said regarding the general shape of the tines. As these are intended to go much deeper than the common harrow, and instead of sliding over vegetable rubbish go under and rive it up, they get clogged up with it, especially if it is formed of the roots of couch-grass.. But if the tine is properly shaped it will never clog up so badly as to require the driver to stop and clean out, unless under exceptional circumstances.

This proper shape of a tine is known as the "swan-neck" curve, in which the point is set well forward and the stalk curves backwards and upwards in a gradual sweep. The weeds which gather in front work themselves up along this until clear of the ground, when they drop off. No other shape, so far as I am aware, will do this; and I have often noticed that even where the tines have the same curve at the ground the weeds will gather and "drive" if there is not this double curve of upwards and backwards.

Points or Shares.—The points or shares next claim our attention, and they are a feature of importance in the proper working of each variety. The drag-harrow, as an example, is a sort

of general-purpose tool, equivalent to a magnified single leaf of a harrow, generally triangular in shape, and provided with both wheels and handles. From its nearness to the ground there is not room for the curved neck to the teeth, and so they are fastened like ordinary harrow-tines. The purchaser must look to see that if the points are curved the curve is in exactly the direction the tool is to go when working, for there is a tendency among makers to fit these into the angles of the framework without reference to the direction of these angles. The result in working is that the whole thing swings round until the tines are following one another in the same lines, instead of each making a track for itself.

In all cultivators above the grade of a harrow, it has been found in recent years desirable to have movable points or shares. These work well in all except the stoniest or rockiest soils, while many benefits accrue from their use. They are easily replaced when worn out, and at a less cost than the smith can "lay" the malleable iron forms; while many different sizes and shapes of point can be tried on the same tool without trouble where the work is of a variable nature. They are mostly made of cast-iron, sometimes with a chilled surface; but great advances have been made in these within the last few years—advances which surprise one when they come to think of it, and which emphasise Carlyle's description of the millions of people who inhabit the British Islands.

Palæolithic man—the man of the early stone age, who is computed to have lived from 10,000 to 50,000 years ago—found out that his flint scrapers and knives worked much better when sharp: the makers and users of grubbers only found that out a few years ago.

I have just been to look at a set of shares purchased along with a three-horse grubber only ten years ago, and which were never used, and without stretching a point I affirm the unworn edges are as thick as the sole of my boot. It is a good grubber too, but the wear of horse-flesh and the inefficient work from blunt shares like these, taken in the aggregate, must have very perceptibly increased the agricultural depression.

The modern point for all cultivators now is made of sheet-steel, malleable, and with one side chilled or case-hardened. This is sharp and remains so in work; and it is wonderful to see how much easier and cleaner it works than the cast-iron form, and how the horses are less pressed and the work better done. I believe we are indebted to the Americans again for this improvement, but am informed by an implement-maker that it is an old idea revived, and that he made such things thirty years ago, but they did not *take*—and it is only now, when "boomed" by our friends across the Atlantic, that they are adopted.

Wheels on Cultivators.—There now falls to be considered the question of applying wheels to this class of implements. There can be only one opinion on this subject, and that is that wheels are an immense improvement. I am not old enough to remember when the ordinary grubber was made entirely devoid of wheels; there was always one—the front one—present, enabling the implement to be kept at a regular depth to a certain extent, the strength and skill of the man supplying the deficiency. I can remember when the grubbers of a whole country-side were made thus; but gradually wheels came in—new grubbers were bought, having side wheels as well as a front wheel, and old grubbers were sent away one by one to have wheels fitted on with the corresponding raising and lowering arrangements. Wheels on a cultivator can scarcely be said to lessen friction as they do with a plough: at most they do so to a very small extent, but they keep the implement at a regular and even depth in working, and admit of nice adjustment to suit the soil, while they make the draught regular and not jerky—a matter of great importance in the saving of horse-flesh. Moreover, they render the man's work easy and pleasant, instead of the excessive straining required in olden times.

There are some, of course—as in the case of wheel-ploughs—who look on these things as contemptible innovations, on the ground that they make the work too easy, and do away with the necessity for a certain amount of skill and strength on the part of the workman. The answer to this is that farm-work is not done for the purpose of allowing men to display their skill and strength, but for producing good crops and making a farm pay; and the system which does the work most easily and with the least skill is the one to follow. The operatives in a woollen factory have not skill or strength enough to use the spinning-wheel as our mothers and grandmothers did, but they can turn out miles of thread much better spun and at a much cheaper rate, and thus the spinning-wheel is thrown aside.

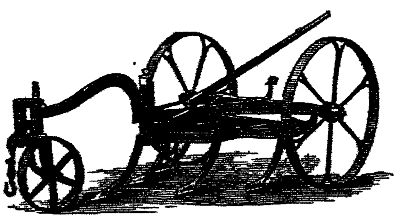


Fig. 19.—Hunter's Grubber.

Improved grubbers with wheels are represented in figs. 19 and 20.

Size of Wheels.—Let me turn round to the wheels again. I may here make some general statements regarding these. First, the larger the diameter of a wheel the more easily is it turned: each spoke is equivalent to a lever acting on the nearest part of

the bearing as a fulcrum, and raising or moving the opposite part. The longer the spoke and the smaller the spindle or bearing, the more easily is the wheel moved and kept in motion where speed or power is not an object. On the other hand, the size of the wheel is limited by the strength of material, and by the fact that the strength varies inversely as the length or size.

A wheel, therefore, has to be adopted which will give the maximum size for ease of turning combined with a moderate weight and structural strength. A diameter of 30 to 36 inches has been found to accord best with all these desiderata; and accordingly the great majority of all our farm implements, such as cultivators, rollers, clod-crushers, reapers, mowers, horse-rakes, and even some ploughs, have their driving-wheels about this size.

But wherever a larger wheel is admissible it is adopted, as in the case of carts, traps, or gigs; and where these are specially desired for ease of draught and speed, the wheels are made of

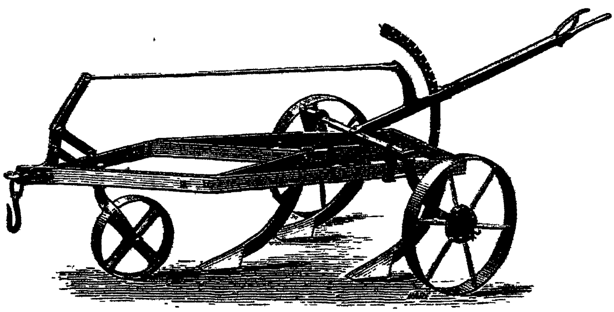


Fig. 20.—Sellar's Grubber.

the largest size. When a heavy body has to be moved from one place to another—such as a load of hay, or a depressed agriculturist weighing 18 stone—it is necessary to save horseflesh as much as possible; and thus London hay-carts and the gigs of men who love a fast horse are provided with wheels of extra diameter, thus exemplifying the fact that many farmers are scientific and are not aware of it.

Let every one, therefore, see that his implements are provided with wheels of a large diameter. They ease the draught considerably by keeping the depth even and regular, while, where the ground is uneven, they do not bump and jolt nearly so much as those of small diameter.

Rollers.

As an instrument of tillage, the roller in all its varieties falls to be commented on.

Wooden Rollers.—The first roller was undoubtedly the trunk of a tree, cut and rounded, and fitted into a frame with shafts. It is a variety which is still considerably used, especially for certain purposes, such as rolling the drills after the mangel or turnip seed is sown, to consolidate them just a little,—a very good practice in a dry district.

Stone Rollers.—The next advance on this was the stone roller, where greater weight was desired—a form also still in use—granite being the stone generally preferred.

Barrel Rollers.—The next advance on these was a desire for a heavy roller which would at the same time be easy in draught, and the manufacture of rollers on the barrel principle was evolved. Large thick planks as staves were fitted together to make an even regular cylinder, and hooped with iron, making an exceedingly useful implement. I have seen, and may say handled, such a one, long ago broken up.

Iron Rollers.—Three-eighth-inch boiler-plate, fitted round a cast-iron framing, is the standard form now (fig. 21), and though

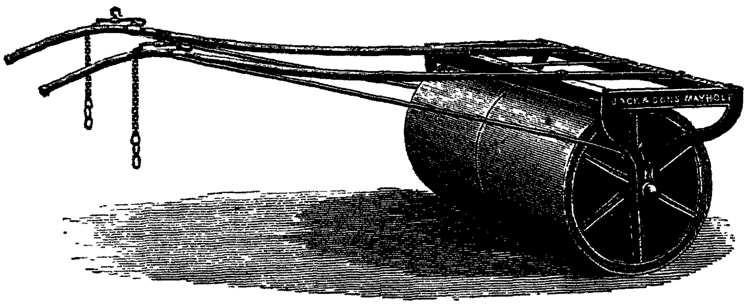


Fig. 21.—Jack's Roller.

we may not have reached finality, yet it is likely that improvements on this in future will be confined to minor details.

All iron rollers, however, are not of equal effectiveness. The remarks above made regarding the diameter of wheels applies equally well to rollers.

The roller of small diameter is a complete mistake: it may admit of the use of cast-iron wholly in its structure, and be lighter, but the stress on horse-flesh is considerably more than with the large barrel. With a 30-inch barrel one horse is quite able to get over 12 to 14 acres in ten hours on grass-land, and 10 to 12 acres on fairly easy working harrowed soil.

An ordinary iron roller weighs about 12 cwt., but where more is desired it can be easily made up by putting logs of wood on the top of the frame, or a flat box filled with stones.

In yoking the horse it is of importance to see that the

draught-chain is in a line drawn from the shoulder-hook to the axle of the barrel. This is the true line of draught in all wheeled carriages, and the more direct the traction the less stress on the horse.

Rollers are always made in two or three parts to facilitate turning, but there is nothing to be gained by having them hinged in the middle, as is the case in some parts of the country. This is done to allow the parts to adapt themselves to the slopes of the ridges, but in practice they never do this, because the roller is straight and the ridge or stretch is rounded, while rolling in any case is best done across the furrows. The hinging, again, necessitates the use of a small drum, so that the whole implement is objectionable.

There is an arrangement in the south in connection with rollers which might be adopted with benefit more extensively. This is the use of a *scraper*, fitted on with a movable hinge. Rolling cannot be done until the land is quite dry, on account of the earth sticking to the surface of the iron. Now there are many cases where rolling the land in a wet or damp condition would do no harm, but even good, if the roller would work. Grass-land is an example of this: if left till dry on clay soil it becomes so hard that little impression is made. Now scrapers are a proved success, and if fitted on with a joint to allow of rising and falling, and kept down with their own weight, they would be a decided advantage. If not required, the scraper could be hooked up out of the way; for of course they, like a brake, greatly increase the friction.

Clod-Crushers.

The heavy rollers known as clod-crushers (fig. 22), of various varieties, come under the same rules. The heavy pointed or fluted iron segments are designed to split and break up hard clay clods by sheer weight and force, but they move all the easier for being of a good fair diameter. Smaller forms are now made for ordinary rolling of corn crops, more especially as a preparation for sowing down with "seeds," and splendid work they do. In order to get them light and handy enough for this purpose they are made small in diameter, thus sacrificing the ease of draught, and requiring two horses where the common roller requires only one, but crushing, pulverising, and "fluting" the soil most beautifully, and leaving the flutings just ready to catch the grass-seeds.

Steam-Cultivators.

The subject of implements is endless, and there is always something new, notwithstanding Solomon's remarks to the

contrary. I have left very little space for *steam-cultivation*, but little space will serve me, as I have not much to say.

It has been a matter of regret to me that steam-farming has not been the success that was at one time anticipated. I believed at one time that farm-work, like everything else, would come to be largely done by steam-power, to be followed later on by electricity or oil as a prominent motive power. When in 1879, in France, a field was ploughed by electricity—the very first application of this force to actual useful work—I was delighted, and searched out all details in the belief that the plough would be "sped" in a way never dreamt of before.

Ten years' residence in Essex, "the home of the steam-plough," has largely modified my opinions in the matter, how-

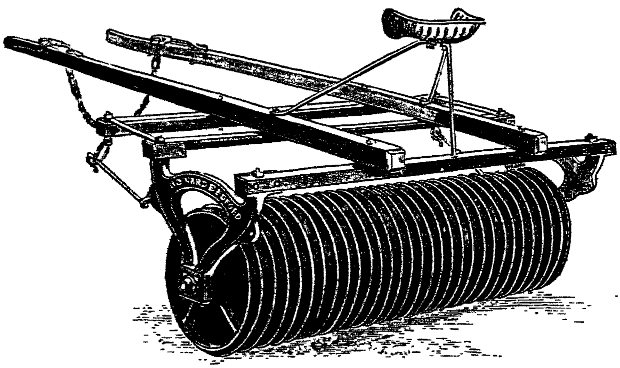


Fig. 22.—Howard's Clod-Crusher.

ever, and I am not very sanguine that we shall have anything else than horses as a motive power in the future.

The *steam-plough* has probably done more harm than good in past days, before the evils of bringing up too much subsoil to the surface were understood, and now very little steam-ploughing is done.

The *steam-cultivator* has done much better, and is in more common use, though it has its limits and its drawbacks. It must not be forgotten that the soil is limited in depth—from 6 inches to 12 inches being the common run—and that with ordinary soils under cultivation from two to three horses can pull our implements, set to any reasonable depth, and there is no gain in getting a ponderous engine to do it. It is only on the stiffer soils that more than this strength is required, and even there it is not always requisite, so that the profitable use of steam is limited to such.

A large farmer in my neighbourhood informed me that he

one year spent £500 on hiring in steam-cultivation, and he did not believe he was one pennyworth the better of it—at least not over the requisite horse-work.

Taken at a dry time and ripped up with the *steam-grubber*, there is no doubt that stubble or fallow is benefited; but for ordinary work, in my humble opinion, the *horse digging*-plough has come to supersede it.

Steam-Digger.—There has besides come to the front within the last few years, and is now a pronounced success, an implement which is likely to prove of great value to the holders of clay arable land. I refer to Darby's improved steam-digger (fig. 23).

It has always been urged as a fault of ploughing, and indeed of much of the usual forms of cultivation, that it compressed

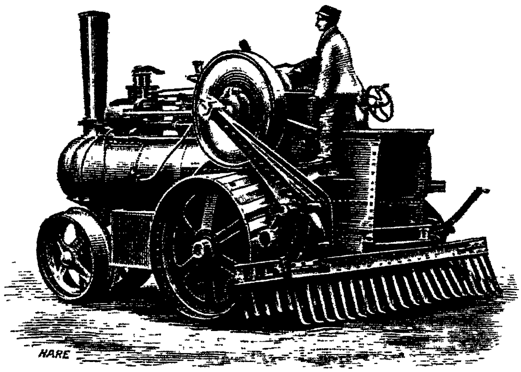


Fig. 23.—Darby's Steam-Digger.

the bottom of the furrow, thus forming a sort of "pan," and plastering up the natural seams, cracks, or pores of the soil by which the water and the roots of plants get access downwards. The ancient *sarcle* or the modern spade (or similar tools) were the only ones which obviated this evil, leaving the soil in a thoroughly pulverised condition, and at the same time having the bottoms of the worked part, next the subsoil, in an open stirred-up state.

It occurred to Mr Joseph Darby of Pleshey, Essex, that an implement constructed for digging on a large scale by steam-power would be calculated to do tillage work in the proper way. Darby's "broadside" digger, exhibited at the Royal English Show at Carlisle in 1880 and Derby in 1881, was the result. I saw and examined it then, little thinking that eleven years afterwards I should have that identical machine at work.

The land is dug to any depth required by setting the tines,

but in practice 8 inches and 10 inches are found the two most suitable depths. The digging-forks are driven by cranks, so arranged that each fork enters the ground in successive order, and thus there is only the full stress on the shaft of one fork at a time.

The "broadside" digger did good work, but its size and weight were against it. It was practically and literally equivalent to two traction-engines stuck end to end, with one large firebox in the middle and a funnel at each end—a form known as the "Fairlie" type of engine. This digger took 21 feet wide at a time and weighed 16 tons. It was evident that such a ponderous mass of iron was not suited for working in ordinary fields; and though this particular implement has been in work regularly up till now, and was in full blast last summer, yet the more improved, lighter, and I may say earlier, form, with the forks fitted "end on," has now been adopted.

Further, as the digging-forks tended to turn over the earth in great unbroken slabs when it was not naturally crumbly, it was found desirable in many cases to have a framework of tines fixed above and behind the working tines, so that the earth in being lifted and thrown back would be forced through these, and so be thoroughly broken up. This it now does efficiently and satisfactorily, so that a stubble-field may be dug up to any reasonable depth, thoroughly pulverised and mixed, and even ridged up—by fixing on mould-boards behind—in preparation for any crop, though the work is specially suitable for fallow.

The illustration (fig. 23) gives a very good idea of the whole implement as it now stands—a traction-engine which may be used as a general motive power about the farm, and on to which the digging apparatus is fixed behind, the general arrangement being very similar to the new haymaking "kickers."

Indeed the first form of digger known to me was more like this latter implement. It was brought out by Garrett previous to 1880, illustrated and described in the 'Implement and Machinery Review,' and it had a large number of small forks fitted on behind and working on one shaft.

The digger is of course best qualified to show its value on *clay soils*, and this for several reasons. On light land there is not the same tendency to clog up the pores or form a pan: the roots can always penetrate and the water get down, no matter how the land is cultivated. Again, on loamy soils the common plough or the digging-plough can be pulled by three horses at as great a depth as there is any need for.

I have myself held a common iron Scottish plough 12 inches deep and 16 inches wide for acre after acre, day after day, on certain meadows in Upper Nithsdale where the soil was a

peaty loam, and with only three horses, and always the same three horses, at the other end of the plough—and these horses were not harassed either, though I was

> "Whiles forfoughten sair enough,
> Yet unco prood to learn."

I may also remark that the horses did not have their corn measured to them in "stimparts," but divided out by a "wecht" of liberal diameter—the breadth of the horse *plus* the diameter of the wecht being just equivalent to the width of the stall; sometimes a tight fit. In those days, however, there were no "albuminoid ratios."

Under such conditions the digger would be out of the question, and possibly out of sight too if the peat were deep enough; while on all similarly easy-working soils a sufficient depth and pulverising effect can be obtained by three, or at most four, horses with some of the chilled wheel-ploughs.

Again, on steep land an engine could not travel comfortably, while on rocky or bouldery soil the digging parts would be smashed.

But on the stiff clays, where a 5-inch furrow is as much as two horses can tackle, and 7 inches the limit for three, there is no question of the benefits to be derived from the use of an implement which digs without bringing up the subsoil to the top and thoroughly mixes the whole.

One drawback, however, I must mention. This is, that by the steam-digger the surface rubbish is not buried completely. The digging-plough, and even the common plough with a skim-coulter, turns the surface weeds down and buries them more or less completely; the steam-digger mixes the whole up, so that its work is best suited for a fallow crop or where the land is fairly clean.

Conclusion.

Although I have by no means exhausted the subject, I must now draw to a close. I will do this with a little moralising. What immense strides have been made in agriculture within the last half-century or so! Personally I can hardly realise how my two grandfathers were able to work their land at all in their early days before iron had displaced wood, and steel the iron, and chilled steel the common steel. And I think my feelings must be common to my day and generation. Old men inform me that I "ken noucht aboot wark," and I believe them, after having seen the old farm implements in the Industrial Museum in Edinburgh.

I am thankful that I did not live fifty years ago, for I believe

in fitting seats for the driver to all farm implements except ploughs, and would have them there too, only the weather is too cold in winter for a man to sit and drive, so that my easy style of doing work would not have suited them. But we live in a progressive age, and some may live to see greater improvements in our implements than have yet been made.

The British farmer is reckoned the best in the world according to certain standards. He stands sadly in need of technical education according to certain other views. If he himself would be humble-minded enough to adopt the latter view, and realise how much his farm implements are capable of improvement, then there is no doubt that changes for the better would follow speedily.

THE AGRICULTURAL LABOURER OF SCOTLAND—THEN AND NOW.

By R. Hunter Pringle, Assistant Commissioner for Scotland to the Royal Commission on Labour, 1892-1893.

Introduction.

Within the last twenty-seven years three distinct Commissions have been appointed to inquire into and report upon the condition and circumstances of the farm-labourer in Great Britain and Ireland.

The Inquiry of 1867.—In 1867 Scotland was surveyed—north, south, east, and west—by five Assistant Commissioners, acting under the instructions of a Royal Commission, upon "the employment of children, young persons, and women in agriculture." Although ostensibly directed towards juvenile and female labour, the work of this Commission resolved itself into a general inquiry, and the report subsequently issued was an exhaustive treatise with reference to agricultural labour in the widest sense of the term.

The Inquiry of 1879.—The Richmond Commission, established in 1879, formed the second instrument of inquiry. The purpose for which this Commission was named had a more intimate relationship with the agricultural depression known to have followed a series of bad seasons, than with the condition of those employed on the land at the time; but it was considered advisable that the Assistant Commissioners, in collecting evidence, should not overlook the labourer or the extent to which his affairs had been affected by agricultural distress.

We accordingly find in the reports of the Richmond Commission much useful and valuable information with regard to the life and condition of the Scottish farm-servant. The inquiry, so far as it related to Scotland, was intrusted to the care of two Assistant Commissioners, Mr George Walker and Mr James Hope.

The Royal Commission on Labour, 1892-1893.—After a lapse of thirteen years the labour question again presented itself before Parliament, and as the result of its deliberations there was appointed, in 1892, "The Royal Commission on Labour," under the presidency of his Grace the Duke of Devonshire. The agricultural department of this last Commission was placed in charge of Mr William C. Little, a gentleman admirably qualified by experience and ability for the responsible duties connected with the office, and it is no secret that those who had the privilege of serving under him attribute much of the success which their reports are believed to have achieved to the unvarying courtesy and unflagging zeal exhibited by their respected senior.

Procedure under the 1892 Commission.—The inquiry of 1892-93 was thus arranged for Scotland: The country, instead of being taken by counties, was divided into districts, each of which was believed to be representative of the agriculture and characteristics of the surrounding locality. Although this order was in most cases adhered to, it was at times considered advisable to prosecute investigations more upon the old basis of county boundaries; and those who have perused the Scotch district reports published in blue-book form, will doubtless have detected the exceptions to which I have referred. Occasions arose when it would have been wellnigh impossible to give a true and reliable description of agricultural life and labour over a large area of varied soil and surface without extending the field of investigation far and near; and when necessary this course was recommended and adopted. Furthermore, in recognition of the large extent of mountain and hill pasturage in Scotland, special reports were prepared from pastoral districts, as distinct from arable or agricultural localities.

The Assistant Commissioners and the Districts visited by them.—The duties of collecting evidence and compiling reports devolved, in the first place, upon Mr Henry Rutherfurd and Mr George Gillespie. To the great sorrow of all who knew him, Mr Gillespie was not spared to complete the work upon which he had embarked, and the place rendered vacant by his death was filled by the writer of these lines. In addition to Mr Rutherfurd and myself, Mr Edward Wilkinson, one of the Assistant Commissioners for England, was deputed to report

upon the agricultural districts of Roxburgh and Berwick-shires, and the pastoral districts of Selkirk, Peebles, and Dumfries.

The arrangement of the work was as follows:—

Mr Rutherfurd visited and reported upon Caithness, Orkney, Sutherland, and Ross; North Lanarkshire and Linlithgow; Ayr, Renfrew, Bute, and South Argyle; Stirling and Dumbarton; Wigtown, Kirkcudbright, and Dumfries.

Mr Pringle—Fife, Kinross, and Clackmannan; Edinburgh and Haddington; the arable district between Inverness and Dingwall; the pastoral district of Breadalbane in Perth, and the pastoral district on the borders of Inverness and Ross.

Mr Gillespie—Moray, Banff, and Nairn; Aberdeen and Kincardine; Forfar and East Perth.

Mr Wilkinson—Roxburgh and Berwick; the hill districts of Selkirk, Peebles, and Dumfries.

The Scope of Inquiry.—The scope of inquiry devolving upon the Labour Commission is plainly set forth in the terms of reference, dated 23d of April 1891: "To inquire into the questions affecting the relations between employer and employed; the combinations of employers and of employed; and the conditions of labour which have been raised during the recent disputes in the United Kingdom; and to report whether legislation can with advantage be directed to the remedy of any evils that may be disclosed, and if so, in what manner."

Divisions of Inquiry with respect to the Agricultural Labourer.—The immediate subjects upon which, as regards the agricultural labourer, information was desired, were:—

1. The present supply of labour.
2. The conditions of engagement.
3. Wages and earnings.
4. Cottage accommodation.
5. Garden allotments.
6. Benefit societies.
7. Trade-unions.
8. General relations between employers and employed.
9. The general conditions of the agricultural labourer.

Subdivisions.—For the guidance of the Assistant Commissioners these nine subjects were subdivided into over 70 parts. For example:—

WAGES AND EARNINGS were separated into

1. Current rate of weekly wages during preceding twelve months.
2. Opportunities of adding to wages by piece-work.

3. Nature of piece-work put out to contract.
4. Prices of piece-work.
5. Mode of payment adopted in
   (*a.*) Hay-time.
   (*b.*) Harvest.
6. Additions to wages by
   (*a.*) Perquisites.
   (*b.*) Allowances.
   (*c.*) Payments in kind.
7. Wages earned by employment during a part of the year in occupations other than agriculture—*e.g.*, wood-cutting, seaweed-gathering, quarrying, &c.
8. Estimated annual earnings, including all allowances, piece-work, &c., of
   (*a.*) Ordinary labourers.
   (*b.*) Labourers skilled in special departments.
   (*c.*) Shepherds.
   (*d.*) Men in charge of horses, cattle, &c.

Within the necessarily contracted limits of this paper, no attempt need be made to follow an inquiry of this exhaustive character into anything like its comprehensive territory, but it has been suggested (and I readily accept the suggestion) that the present is a favourable opportunity to compare and contrast the position, the life, the work, and the general condition and circumstances of the Scotch farm-labourer of to-day with the *entourage* of agricultural employment in days gone by.

Difficulty in obtaining reliable Evidence concerning the far past from Employers.—The reader of the reports published in 1893 cannot but be struck by the absence in most of them of any very clear or decided reference to the surroundings of the Scotch labourer's life forty or fifty years ago. My experience as an Assistant Commissioner was, that although farmers of long standing remembered many things about the good old times, there was with relation to the labourer, his wages, housing, and condition, so much "thinking" and so little "knowing," the evidence could not be always accepted as trustworthy, and had to be treated as hearsay. Systematic book-keeping, not over-popular among the present race of farmers, was even less in vogue forty years ago, and statements made with reference to wages and earnings were generally hazy and obscure.

Payments in kind, in the shape of meal and milk, the keep of a cow, potato-land, coal or peat, "pack-flocks," &c., prevailed to an even greater extent then than now, and the strange habit of attaching little or no importance to the value of perquisites which do not take the form of silver and gold appears to have been transmitted from generation to generation.

In our endeavours to arrive at fair estimates of the labourer's

earnings before the Crimean war, we were therefore invariably brought face to face with the fact, that although the money wage was remembered in the great majority of cases, no exact statement or valuation of the perquisites could be obtained. It is therefore only by having recourse to the Reports of the 1867 Commission and a few reliable returns made by witnesses in one or two counties, that the elements required for a paper such as this can be collected.

Points of Similarity in Agricultural Employment—Then and Now.

No Change in the Scotch Labour System.—In some ways the position of the Scotch agricultural labourer has undergone no change. The working staff of a large farm is still made up of a steward or grieve, a head or foreman ploughman, with ordinary ploughmen (one for each pair of horses), an "orra" man or orra men, who do not attend upon horses, but perform the ordinary hand-work of the farm, or assist the women-workers at certain times, a shepherd, a cattle-man, and the women-workers and boys who labour beside them.

Nature of Employment.—To these servants regular and continuous employment is given, be the season summer or winter, the weather wet or dry. Occasions do arise when prolonged frost or wet weather prevents the "workers" from doing outdoor labour, and a short break in the continuity of their employment may ensue; but from all parts of Scotland it is reported that farmers, rather than see their women idle and at home against their will, go out of their way to find occupation for them about the steading or under cover. There is indeed every reason to believe that the "worker" is treated with far greater all-round consideration and generosity by the present race of farmers than could have been said in the days of yore.

This is to a certain extent due to the great improvements which have been made in the character of our farm-buildings, and the roofing over of cattle-yards formerly open and unprotected, as well as to the feeling of independence which urges the agricultural labourer (male or female) of to-day to vehemently resist what may be considered unnecessary exposure or harsh treatment; but it is chiefly traceable to a change of sentiment on the part of the employer. Old ideas have passed away, old customs have disappeared; and in Scottish agriculture the number of those who still conduct their business or manage their employees *more majorum* is remarkably small.

Conditions of Engagement.—Nor has any conspicuous change taken place in *the practice of hiring and period of engagement.* The Assistant Commissioners of 1867 reported that the usual

custom was to hire married men who occupied farm-cottages for a period of twelve months, and unmarried servants, male and female, for six months. It was further stated that "the hiring is generally effected at fairs or feeing-markets."

In 1893 it was found that yearly or half-yearly engagements, coupled with an upstanding wage, were general and popular among married labourers, and that over a large part of Scotland single men preferred and secured the same terms. "But there are many advocates for and supporters of indefinite engagements and short notices, in the vicinity of mines and manufacturing towns."

Women-workers are generally the daughters or wives of the ploughmen and orramen, and the same engagement which binds the parent is supposed to bind the child. How far this supposition holds good at law I should hesitate to say, but so far as I can learn from the Scotch reports, cases of dispute have seldom occurred. This is not because women-workers are indisposed to "leave the land," but rather that farmers seldom throw any obstacle in the way of those who express their intention of entering other service. No example of a worker "bolting" after pay-night appears to have been submitted in evidence, but I was told of some farmers who had suffered inconvenience from the departure of their smartest workers at short notice in busy times.

A growing Desire for Short Engagements.—There is not the least doubt that in many parts of Scotland there is a growing desire for short engagements in agricultural service; indeed in some localities the mind of the single man is intent upon the abolition of the yearly hiring. In nearly every district report, allusion is made to the unpopularity of yearly or half-yearly hirings among a certain portion of the younger and unmarried section of the labourers, and as this feeling is of recent origin, we may do well to ponder over it.

Migratory Habits.—So far back as 1867 the restless and unsettled condition of our farm-labourers formed a subject of complaint. Mr Norman, writing of the north-eastern counties, says: "Farmers constantly complained of the unsettled condition of their servants, who, they say, are always desirous of flitting, and they seem to evince no attachment to either master or place; in this respect they greatly differ from English labourers."

Mr Culley, reporting from the midlands and south-eastern counties, thought "this migratory habit carried too far, especially in the case of married men." The restless spirit so frequently alluded to by the Assistant Commissioners of 1893 is therefore no new story; indeed, if we carefully analyse the reports of both periods, we find history repeating itself in this

connection. A certain proportion of our labourers have always been addicted to a roaming life, while others are content to spend many years, often lifetimes, on one farm. Some tire of a place in a year; some remain four or five years on one farm; some, once settled in a comfortable cottage and under a good master, continue therein till death them do part.

No evidence was brought forward to show us that periodical flitting was conducive to the labourer's happiness or prosperity, while several examples of men leaving a situation against which they had no real complaint and failing to secure another, were stated. Knowing, as we do, that this foolish fashion has enslaved a certain proportion of our farm-servants, it would appear to be little short of insanity to encourage or even suggest the introduction of indefinite engagements (which in reality mean no engagements at all), with monthly notices to quit.

The Advantages of Long Engagements.—Chiefly owing to the old-established economy of Scottish agriculture—an economy intimately connected with continuous employment, resident labourers, and long engagements—our system of farming and field-labour has risen to the exalted position which it now occupies among the nations, and it is in my opinion highly probable that to cut into or experiment upon our manner of hiring, would be tampering with one of the corner-stones upon which the admirable edifice rests.

Time after time, the Scotch custom of long engagements has been assailed by advocates of indefinite engagements with weekly or monthly notices; but do these gentlemen take into consideration or attach any importance to the results which have followed the observance of the two systems they are contrasting? Surely not.

Let us examine these results, as they affect both employer and employed. Throughout the five counties of Cambridge, Norfolk, Suffolk, Essex, and Hertford, the conditions of employment are—generally weekly engagements, but a few horsemen and stockmen for longer periods. Each horseman has to look after from three to six horses. The weekly wages and earnings are as follows:—

County.	Day-labourers.	Horsemen.	Stockmen.
	s. d. s. d.	s. s. d.	s. d. s. d.
Cambridge . . .	14 0 to 16 6	14 to 15 0	14 0 to 16 6
Norfolk	13 6 " 16 4	15 " 20 0	14 0 " 16 0
Suffolk	13 0 " 17 4	16 " 18 6	14 6 " 18 0
Essex	13 6 " 17 6	16 " 18 0	16 0 " 18 0
Hertford . . .	11 6½ " 16 0	15 " 20 0	14 0 " 19 2

It must also be observed that as the farm-cottage system does not obtain in these counties, many of the labourers have not only to pay cottage rents, but frequently to travel long distances to their work, and also that when on piece-work they sometimes labour far over the regular hours.

Now take, on the other hand, the estimated weekly wages and earnings in a few Scotch counties, where yearly and half-yearly engagements are in vogue:—

County.	Day-labourers.	Ploughmen.	Cattlemen.	Shepherds.
	s. *s.*	*s. d.* *s. d.*	*s. d.* *s. d.*	*s. d.* *s. d.*
The Lothians . .	16 to 20	17 9 to 20 6	18 0 to 22 1	21 6 to 29 3
Fife	15 " 21	18 $3\frac{1}{4}$ " 20 3	18 0 " 20 10	16 10 " 21 2
Breadalbane (hill) .	18 " 21	18 0 ...	...	19 $2\frac{3}{4}$ " 21 6
Inverness & Ross (hill)	15 " 18	17 8 to 18 $1\frac{1}{2}$	...	19 $7\frac{3}{4}$ " 22 $6\frac{3}{8}$
Roxburgh & Berwick.	17 " 20	17 4 " 20 6	17 4 " 20 6	20 0 " 23 4
Stirling & Dumbarton	18 " 24	19 0 " 21 6	19 0 " 21 6	19 0 " 21 6
Ayr & Renfrew . .	16 " 21	18 0 " 24 0	18 0 " 24 0	18 0 " 24 0
Lanark & Linlithgow.	15 " 21	20 0 " 21 0	...	20 0 " 21 0

These labourers sit rent free, and are always near their work. Moreover, their labour does not keep them in the fields after "lowsing-time," and no ploughman has more than two horses to look after. It is, notwithstanding, remarkable that in spite of the larger wages paid in agriculture throughout a few counties in the north of England and in Scotland generally, the land is cheaper wrought, and the cost of cultivation in all its branches somewhat lower, in the north than south. This is no doubt partly due to the greater efficiency of the labourers themselves, their more methodical way of going to work and greater steadfastness in keeping at it, and also to the fact that the English labourer gluts himself with beer, which produces a sensation by no means conducive to energetic labour, whereas the Scotchman carries neither flask nor flagon.

Our contention is, that the efficiency and steadfastness of the Scotch labourer have been promoted by regular service and long engagements, whereas short terms of engagement have discouraged both; and from the reports compiled last year we are further supported in our argument by numerous remarks, which show that both in England and Scotland it is the inferior type of labourer who least inclines to continue long in one situation, and is loudest in his condemnation of yearly hirings.

Unsettling Influences at work.—But these reports tell us something more. They ascribe much of the exceptionally unsettled and restless spirit of the agricultural labourer in certain localities to the proximity of mines and manufacturing towns, and the teaching of agitators, social and political. Forty years

ago, agitators and agitating bodies were like the conies, a feeble folk; now their ramifications extend far and wide, sowing discontent and breeding enmity between master and man in almost every branch of trade.

Suppose that part of their programme which proposes to substitute indefinite for yearly engagements were adopted, it would simply mean that on the first blush of a revival of town trade, scores of young men and women would rush from the land to towns and mines, producing an over-supply there and a labour famine in contiguous rural districts.

This has already happened in some parts of Scotland, where employers had been by force of circumstances driven to hire farm-labourers subject to a month's notice to quit; and it is important to observe that the benefit to the labourer (if there really was any benefit) proved ephemeral in its character, for the unskilled and inexperienced country hand was the first to be paid off when a reduction in the staff had to be made.

From all that has been said and written, we are therefore led to conclude that, although love of changing from farm to farm has existed among Scotch farm-labourers for many years, a new form of discontent and disquietude has recently sprung up, and threatens to spread over such districts as are unfortunate enough to be within reach of competing industries or other unsettling elements. And I think common-sense tells us that a remedy for this regrettable state of affairs need not be sought for in the substitution of short for long engagements.

Female Labour.

Decrease in Supply of Female Labourers.—Anent *female labour* there are a few changes worthy of note. Before the date of the first Commission, women willing to work out of doors were in good supply. Not only did the "bondage" system prevail in the south-eastern counties—notably Haddington, Berwick, and Roxburgh—but female bothies were numerous in many parts of Scotland. Women in these days handled the sickle at harvest-time, and even mothers and wives were wont to work out of doors.

In 1867 we are told that "of late years there has been less inclination on the part of women to go out to work, and there is more complaint of a scarcity of women and young workers for green-crop land. In some of the eastern and southern counties women from Skye and the Western Highlands are found settled in small parties or bothies, and in various parts Irish immigrants arrive in considerable numbers. In many counties the bondage system . . . is still in force."

Certainly a very great change has come over the employment

of women since the Crimean war times, for in the reports to the Labour Commission of last year we have it that females are "very scarce" everywhere, "hardly known as labourers now at all" in some districts, and "not to be had for love or money" in the vicinity of manufacturing towns.

The *female bothy* is almost an extinct establishment; and judging from the absence of the word in Mr Wilkinson's report upon Roxburgh and Berwick, the "bondage" system which prevailed in my young days of twenty-five years ago has either died out or been greatly modified. In East Lothian, bondage is no more, and female bothies can be numbered on one's fingers. Married women are in these days seldom seen in the fields so long as their husbands are alive, and those who as "cottars" do take farm service are either spinsters or widows who have no other means of earning a livelihood.

Causes for the Scarcity of Women-workers.—The causes for this scarcity, this growing scarcity of women-workers, are generally well known. Girls do not like field-work, they object to cold and dirty jobs, and they can earn better wages and mix in better society elsewhere. And so they can and so they do. Why should our buxom country lass waste her charms on a decent, honest, lumbering ploughboy, when she might be improving the time among the dapper flunkies, the padded English Highlanders, or the ubiquitous policemen of Edinburgh or Glasgow?

Field-work for Women.—There is another matter with reference to the employment and scarcity of women in agriculture to which I must allude. The employment of women in field-work has been called "one very marked feature of Scottish farming," and perhaps there is no part of our agricultural *economy* so well worthy of the name as the system of doing by female hands and at female's wages that which in England is chiefly done by men. There are many jobs on a farm well suited to women, where a good woman will do as much as a man.

Injustice to Women.—There are, again, other jobs where women are equal to men, although the work be rough, uncomfortable, and altogether uncongenial. No one can look at a party of workers shawing turnips ankle-deep in the miry clay, their arms and petticoats dripping with water, or with snow on the shaws and the thermometer below freezing-point, without feeling that the 1s. 4d. a-day which they are earning is a poor thing in comparison to the 3s. which the carter, who walks alongside the loaded and rides in the empty cart, is making.

Equally undeniable is the injustice to women when they absolutely lead the men at singling-time, doing as much and as good work for 50 per cent less wages. Employers do not think

of these things; but the workers and their parents do, and it is as plain as daylight that unless some steps are taken to rectify the subject of complaint, the day is not far distant when the presence of women in the Scotch farmyard or turnip-field will cease to be "a feature in Scottish farming."

It is all very well for farmers to talk about the fine ideas of women in these days, and their craving for society and its concomitants. We Assistant Commissioners in the proper discharge of our duties must hear what both sides have to say, and it was very plainly stated to one of the four representatives of the Labour Commission in Scotland last year—the writer, to wit—that although some leave field-work because they dislike it, others do so because they feel the injustice of the present system and rate of remuneration at certain times.

Forty years ago, women working on farms had to take what they could get or go idle, for other employment was scarce and factory life was in its infancy. Now the scene is changed, and no well-educated girl with a spark of ambition and pride about her need toil among the "tatties" for lack of opportunities to better herself in a different branch of employment. Our women-workers have undoubtedly hoisted "the banner with the strange device—Excelsior."

Hours of Work.

Shorter Hours.—With respect to *hours of work* it might also be said "tempora mutantur, nos et mutamur in illis" (the times are changed, and we with them).

About the year 1843 "farm-servants in some parts of Scotland worked eleven hours in the field." Between that year and 1867 a change must have taken place, for we are told by the reports on the "Employment of Women and Children in Agriculture," that in Scotland the hours generally observed were ten in summer and from daylight to dark in winter. It must not be forgotten that, in addition to what may be called their regular working hours, ploughmen have extra duties to perform in attendance upon their horses, and that in the shortest days odd jobs are or were invariably performed before "yoking"-time.

A gradual Abandonment of Exactive Labour.—Old farmers frequently refer to the time when most of the threshing was done before break of day, and although it would be too much to say that the habit has entirely disappeared, there is ample testimony to the fact that there are very few districts where what were once universally accepted as the entitlements of masters in the matter of winter hours, are still exacted. The reports of 1893 show, that whereas in some counties jobbing before daylight in winter has almost disappeared, there are nevertheless

districts where it is still customary. In the northern counties (taking the Forth and Clyde Canal as the line of demarcation) "the ploughmen are *often* employed in the early morning and after five in the afternoon in dressing corn, threshing, &c." —(Gillespie in Moray, Banff, and Nairn report.)

From Caithness, Ross, and Sutherland, Mr Rutherfurd reports: "It is the practice on *some* farms to have the men at stable by five o'clock on winter mornings, and to employ them in the barns till daylight enables them to go to the fields." Again, with reference to Wigtown, Kirkcudbright, and Dumfries, we learn that in winter "odd jobs in or about the steading occupy the ploughmen till daylight."

In Fife, Kinross, and Clackmannan the customs are thus described: "On many farms during the shortest days the ploughmen are working in the yard or about the yard for two hours before daybreak." "No such thing takes place in the Lothians," nor does Mr Wilkinson seem to have had any experience of it in Roxburgh and Berwick.

Mr Rutherfurd finds that in North Lanark and Linlithgow "barn-work till daylight was scarcely heard of. The practice of returning to the stable at eight in winter nights is fast dying out."

Contrasting the evidence given in 1867, 1879, and 1893, it may be fairly stated that long ago working by lantern or lamp light was practised all over Scotland, both with respect to morning hours and the 8 P.M. stabling-up time, but that *within the last twenty years both customs have been on the decline.*

The evidence upon this question of hours is not only very bulky, but rather indefinite—the reason no doubt being that labourers are greatly exercised thereby, and the voices of those who have to strip for work before daylight are all the louder because others employed in the same parish are not so treated.

Recent Innovations.—But the customs of the past have fallen down and worshipped at the shrine of civilisation and progress in other ways. What would have been the feelings of the farmer of forty years ago if brought face to face with the knowledge that his hinds not only partook of a second edition of breakfast at the end of the rig, but indulged in afternoon tea in the field? So it is in many parts of Scotland now, and so it will continue to be. People may say that this innovation has little or no significance—peradventure they forget that there is such a thing as "the thin end of the wedge."

Demand for Shorter Hours.—This is no place to discuss the question of shorter hours in agriculture, but it is right to say that all over Scotland the labourer objects to the present length of working day, and supports his argument for a reduction of hours by asserting that "a ten-hour day is oppressive," and that

"a labouring man will do as much in nine hours as in ten." The former of these assertions we must, with the reports of former Commissions before us, describe as *a recent discovery*, and the latter requires elucidation, and is open to contradiction.

Piece-work unpopular.—Piece-work, so common in England, does not appear to have made much headway in Scotland. Even at the present day it is practised to such a small extent as to be hardly worthy of notice.

Mr Rutherfurd describes piece-work as "out of the question for the regular working staff of a farm." In Mr Gillespie's report the subject is either ignored or discussed in terms similar to Mr Rutherfurd's. From the Borders the voice of Mr Wilkinson proclaims "there is scarcely any piece-work"; while by the other reporter it is said "piece-work is very little practised in any of these districts. It does not suit either employer or employed."

Yet the Commissioners all agree that casual labourers do at times work by the piece, and there can be little doubt that the habit of letting out turnip singling and pulling by the 100 yards or acre, has been introduced during the past two or three decades. From what we have seen of task-work in England, it does not appear at all likely that this method of conducting farm work will gain ground in Scotland. Scotchmen like to see their swedes carefully singled, and the "chopping out" or "scoring" of the root-crop as practised in many parts of the arable counties south of the Humber, would closely resemble to northern eyes and minds the consequences likely to accrue from half an hour's occupation by a bull of a china-shop.

Drainers, &c.—Since the commencement of bad times—say within the last ten or twelve years—a great reduction has taken place in the quantity of employment given in draining and wall-building, both of which are generally done by the rod or chain; and it is further to be noted, with respect to Scotland as a whole, that either from the absence of this description of employment or the presence of competing industries, the number of persons generally designated "drainers," "dykers," and "day-labourers" has sensibly diminished. Indeed so marked is the present scarcity, that in some isolated districts trained hands would have to be imported were land improvement or reclamation on a large scale determined upon, and extra hands required to carry it out.

Immigration of Labourers.—Twenty-five years ago Scotland, just before harvest-time, was inundated with *immigrants from Ireland;* and indeed for several weeks in late spring and early summer, after the potatoes were planted and the turf cut in the "Green Isle," the cry was "Still they come." Now, Irish immigration is confined within very narrow limits, and, as

may be seen by the reports, it has altogether ceased in some counties where formerly it existed to a large extent.

Spread of Mechanical Agriculture.—Machinery has superseded manual labour, and is likely to continue to do so. There are many farms in Scotland where, instead of requiring ten or twenty extra harvesters, the whole of the work is now done by self-binders and the ordinary staff of regular labourers. For the same reason the labour of the farm-servant has become less severe, and his duties have grown to resemble more closely than ever those of the workman in an engineer's shop.

It is only among the mountains (and seldom even there) that one now hears of the "bandwin-rig" method of cutting and stooking corn, and everywhere the thud of the flail has given place to the hum of the high-speed drum. Even the splash of the lazy water-wheel has been silenced by the cough of the traction-engine—everything pointing to change and haste.

In the foregoing paragraphs an attempt has been made to describe a few of the ways by which in its passage the wheel of time has left its mark on the track of agricultural labour in Scotland, the object of the writer having been in the first place to compare the present with the past in relation to *the conditions subject to which the labourer received his employment.* Let us now turn our attention to

The Labourer's Home Life.

Cottage Accommodation—"Then."—There is no lack of evidence to show that long ago—say between 1840 and 1855—the cottages of the labouring classes in Scotland were of the most wretched description. "Sheds with four walls, without partitions, often without windows, sometimes without chimneys," they have been called. "Deficient in number, insufficient in accommodation." "No better than the pig-sties of present times." "Dirty, stinking, abominable places." Old labourers are in no way slow to recite their recollections of cottage life "when we were boys," and certainly some of the descriptions strongly remind one of the hovels of Connemara or the "hives" of the Hottentot.

The Axe first laid to the Root of the Tree.—At what exact period the improvement of farm cottages had birth or became general, neither reports nor statistics afford much information; but from the evidence submitted to the Royal Commission of 1867, it is apparent that for some years prior to that date the larger landed proprietors of Scotland, and especially the south of Scotland, had expended considerable sums of money in that direction. One of the Assistant Commissioners of 1867 says, with regard to a parish in Dumfriesshire: "I visited some

cottages with only one room, and that room crammed with box-beds, on which families of eight or nine persons live and sleep. The thatched roofs were in a state of mouldering decay, the mud floors worn into holes, and the walls, even in the month of June, were saturated with moisture." Following upon this, the Commissioner goes on to say: "The Duke of Buccleuch has within the last ten years expended £50,000 in building and improving cottages. Their arrangement and accommodation leaves nothing to be desired."

What has been described of Dumfriesshire may with perfect safety and in all truth be stated generally of the more fertile parts of Scotland. About the time when land began to rise in value and rents to increase in volume, the labourers' cottages were very wretched, but gradually the old houses were pulled down and new ones built.

Characteristics of Cottages built between 1850 *and* 1860.—Between the sheds of yore and the ornamental dwellings of present times there is a vast difference; and it is clear that the idea of substituting houses with a kitchen, parlour, scullery, milkroom, and two or three bedrooms for one-roomed "rickles," never crossed the minds of the earliest cottage-reformers. No—the progress was gradual, and in time and tune with public opinion.

Mr Boyle, in 1867, says: "The *old* type of cottage consisted of a kitchen, containing a couple of box-beds, or perhaps three—one for the parents, one for the boys, and one for the girls,—and a vestibule, and pantry or storeroom. The *new* cottages have *generally* a bedroom. There is often a loft over the kitchen, ascended by a ladder from the pantry, and if there are one or two boys at home, a bed will be put up for them there, but there is no light except what comes from the pantry."

In Kirkcudbright at this time "a gradual improvement" was said to be in progress, and one estate is mentioned on which "all new cottages were built with three bedrooms, a kitchen, and scullery; the cost of a pair of such cottages being £120." In order to show that the class of cottage built about 1860 to 1867 was quite in keeping with the aspirations and ideas of the day, Mr Culley quotes from two correspondents:—

A landlord. "On my farms the cottages are excellent; *almost all have two apartments.*"

A minister. "I do not see any necessity for a farm-labourer's cottage containing *more than two apartments*, and for, perhaps, one-third of the whole number on a farm, *one room of good size would be sufficient.*"

Cottage Accommodation in 1867 *in the Lowlands.*—Mr Culley expresses his opinion that "farm-labourers are now [1867] better housed in the lowland part of my district [midland and

south-eastern counties] than in any of the south-midland counties of England; and I know no county in England where the average cottage accommodation is so good as in Berwickshire—a remark which would also apply to part of Roxburghshire and East Lothian." Mr Culley, nevertheless, thought that there was still great room for improvement on outlying portions of large estates and on smaller estates subject to heavy burdens.

The order of merit for his ten counties with regard to supply and condition of cottages is—1, Berwick; 2, Roxburgh; 3, East Lothian; 4, Selkirk; 5, Fife; 6, Mid-Lothian; 7, Peebles; 8, West Lothian; 9, Stirling; 10, Perth.

Cottage Accommodation in North-Eastern Counties.—Of the north-eastern counties, Mr Norman reports: "Although I had no reason to think that there was a serious deficiency in the quality of the cottages, they appear to me to be, as a general rule, totally insufficient in number."

Cottages at the time of the Richmond Commission.—Coming now to the information collected by the Assistant Commissioners on the Richmond Commission, 1879-82, and tabulated by Mr W. C. Little, we are led to conclude that during the interval between 1867 and 1882 a steady displacement of old and substitution of new cottages had gone on, and that not only had there been a marked improvement in size and internal arrangement, but a considerable increase in the number attached to farms. In the southern counties the custom of lodging and feeding farm-servants in the farmhouse was then being undermined and supplanted by the "farm-village" system, and in the Border counties almost every farm might at that time be said to be fully supplied with comfortable and commodious labourers' cottages. Mr Hope expresses his opinion succinctly but distinctly with relation to his fifteen southern counties: "Cottages have been greatly improved in all counties;" while Mr Walker's table from the north, if not so satisfactory as his colleague's report, nevertheless points to considerable improvement. Some of Mr Walker's counties complain—Dumbarton, for instance, says: "There are few cottages on farms for labourers, and the want of them is said to be much felt for married servants." Others express themselves as thankful for small mercies, but in need of more. Kincardine experiences "a want of labourers' cottages in some districts where *crofts* are not numerous. In many cases, increased and improved; but more are wanted yet." The island of Lewis is short and savoury: "Huts without chimneys; cattle in the same dwelling."

Causes for the Disparity in Cottages in different Localities.—It is often asked why in the matter of cottage accommodation certain counties of Scotland have during the past thirty or forty years fared so much better than others. Why, for instance, should

Dumbarton and the Highlands generally compare so unfavourably with Berwick and Roxburgh? The explanation is, we think, simple enough.

Wherever industries in various forms exist, it is seldom that all members of a family betake themselves to one branch of labour. In Clackmannan we find coal-pits, breweries, distilleries, factories, &c., and agriculture, crowded into a small superficial area, and the various members of one family may take part in two or three different branches of employment. Under these circumstances there was no inducement for landed proprietors to build many cottages for the sole use of farm-labourers or convenience of farmers.

Nor are we warranted in assuming that farmers in such localities as come under the above description ever sought from their landlords that quantity of cottages which they would have required had family labour been the order of the day. They seem to have accepted the position of affairs, and conformed to the alternative of submitting to those temporary inconveniences which invariably beset agriculture when prosecuted in the teeth of a multiform labour-market. Of late years, so disastrous have been the consequences of labour competition upon the supply of agricultural servants, that the minds of farmers have reverted to the inducements which comfortable cottages, coupled with constant employment, are believed to offer to the working man. And doubtless the farmer was strengthened in his expectations by observing how comfortable was the housing of the ploughman in counties where the farm-village system prevailed, in comparison with the accommodation available for employees in town industries or coal-pits.

Assuming this theory to be correct, the conclusion we arrive at is, that the complaints of inferior and insufficient labourers' cottages, contained in the reports of the Richmond Commission and repeated in those of last year, were due, not so much to negligence on the part of landlords, as to the peculiar circumstances of the districts from which the complaints proceeded, and the sudden change of front which followed the discovery that a great increase in farm cottages presented a good opportunity of securing a supply of resident and fixed labourers, snatched as it were out of the grip of competing industries.

The writer would also add that, throughout a large portion of the mining and manufacturing districts, the soil is of poor quality, and let at low rents, and that during the last twenty years arable farming there has largely given place to temporary or permanent pastures. Hence, there was neither the ability on the part of the owner to build, nor the necessity on the part of the occupier to have, an increased number of labourers' cottages.

This, however, does not satisfactorily explain (nor is it intended to) the fact that in those localities to which the reader's attention is at present called, many of the existing cottages stand in need of enlargement and repair.

When treating of the scarcity in number and inferiority in quality of labourers' cottages, mentioned in all reports from the Highlands, we pass from the region of theory into the domain of plain fact. The presence of *crofts* and employment of persons who lived in crofter villages or houses, answered the purposes for which in purely rural and agricultural districts the farm-village system was originally designed. So long as men and women abounded among the crofts and were found willing to sell their labour to the farmer, there was obviously no need for the number of cottages required in localities devoid of small holdings and a redundant population.

Now, of late years crofting, partly from artificial, chiefly from natural causes, has melted away like "snaw-wreaths in thaw," and the necessity for resident labourers attached in considerable numbers to individual farms, has arisen.

Here, again, a demand somewhat suddenly presented itself before landed proprietors, which, to satisfy, of necessity required time. Although one cannot but regret the deficiency and inferiority of cottages in some northern districts, and urge estate-owners to strive towards the remedy of the complaint, we must not lose sight of the fact that immense sums of money have been spent, extraordinary improvements effected, and most laudable efforts made by proprietors during a series of years indelibly connected with falling rents and decreased incomes.

Explanation of Superexcellence in Cottages in some Districts.—The admirable equipment of Berwick, Roxburgh, and East Lothian farms with cottages superior in quality, character, and number to any other part of the United Kingdom that I have any knowledge of, is due in the first place to the absence of competing industries and crofter houses and villages, and in the second, to the presence of large and wealthy proprietors, extensive holdings, and fertile soil. The presence of so many "yeoman farmers," gentlemen who not only keep hunting-horses but know how to ride them; the influx of persons of capital to their beautiful dales and glens; the inducements successfully held out to damsels with long purses to cast in their lot with the gentleman-farmer of the Border-land; and the refinement of society known only to those who have mixed in it,—these long ago combined to produce in Roxburgh and Berwickshire that form of labour and land management which detests the farm-kitchen system and abhors bothies, but rejoices in substantial farm-buildings and excellent labourers' cottages, and insists upon a full supply of both.

Long before the era of remodelling labourers' dwellings in the northern counties, a reformation had set in and spread the light throughout the south; and it is not fair to the Highland laird, nor for that matter to the Kinross landowner, to miscall him, simply because his estate is not so well equipped in the year of our Lord 1893 as that of his contemporary by the heel of Cheviot or the brink of Tweed.

General Remarks on Cottages in Scotland.—I am of opinion that at present, take Scotland as a whole, about one-half of the farm cottages are very good and of recent construction; a large fourth not quite what they should be, but capable of being put right by re-roofing, heightening of the walls, enlargement of the windows, and draining the foundations; and a small fourth, bad in every respect, and so faulty in fundamental principles as to be beyond the range of the architect or mason. I would also corroborate the opinion of Mr Culley in 1867 as to where the cottages are best and worst. Both north and south of the Forth, the best will be found to the east, the worst to the west. The larger and wealthier the estate, the better the farm buildings and labourers' cottages, and the better the cottages the more satisfactory and efficient the labourers.

What constitutes a good and suitable Labourer's Cottage?—The free use we have made of the adjective "good," with its two degrees of comparison, reminds me that the question of what constitutes a good and suitable dwelling for a farm-labourer has not received any attention. A cottage may be a bijou residence and a fine example of architectural design and builder's handicraft; it may be externally elegant and internally replete with comfort and conveniences; but the elegance and the repletion will be altogether thrown away on a poor ploughman's wife with a flock of squalling children and babies, who can only be kept out of mischief by a liberal and constant exhibition of "treacle pieces."

Without for a single moment underrating the advantage of a good, commodious, and convenient cottage, there is every reason to believe that an unnecessarily large or grand cottage is more a nuisance than a benefit to the greater proportion of farm-labourers; and during my wanderings in Scotland last year I saw many instances of money wasted in this way. Frequently I looked over cottages where the whole of the family were stowed away in the kitchen and parlour—the "but and ben"—and two good extra bedrooms converted into lumber-rooms or potato-stores. Our labourers *will* crowd together in winter; as the Irishman says, "It's the hate that draws us, sure." It is true that most of these ornamental and exceptional dwellings were occupied by gamekeepers, gardeners, foresters, estate ser-

vants, or at times farm-stewards; but it is nevertheless the case that in some localities unnecessary grandeur has been imparted to and money spent upon ordinary farm-labourers' cottages, and I am strongly tempted to apply the word *foolish* to such proceedings.

Landlords would not only make their money go further, but do *far more real good* to the persons whose benefit they desire to promote, by exercising a little moderation, and recollecting that until the labouring man is in a position to use and has learned to appreciate spare rooms and parlours, he will not thank you for them.

Different Systems of Housing.—There are still three distinct systems of housing and keeping agricultural labourers in Scotland—(*a*) the farm-village or farm-cottage system; (*b*) the farm-kitchen system; and (*c*) the bothy system.

Decadence of the Farm-Kitchen System.—Within the past thirty years the *farm-cottage* system has very greatly increased, and on most of the large farms in the south it has driven out the *farm-kitchen* custom, and largely taken the place of *bothy life.* At present, the boarding of labourers in the farmer's house can only be said to be in practice on places occupied by working farmers, and many of them dislike the system and state their intention of discontinuing it. I do not recollect visiting any farm in Fife, Kinross, Clackmannan, Edinburgh, Haddington, Beauly, and Inverness district, over 300 acres arable, where any of the men were fed in the house; and from personal knowledge I can bear similar testimony with reference to most of Roxburgh and Berwickshire. Farmers complain that the men are critical as to the food they get, and that it is a most expensive affair when butcher-meat has to be given at least once every day; while their wives object to the inconvenience and trouble connected with it. Even the house-servants demur to men coming in from the fields or cattle-yards to a clean kitchen.

It would be impossible to show by a table the districts where the *farm-kitchen* system is still observed, for it is ruled more by the class of farmer and size of farm than by county or parish boundaries.

The Bothy System.—The bothy system is also on the decline, but over a large portion of the country it is still extensively practised. From particulars collected in Fife, Kinross, and Clackmannan, 36.4 per cent of the men and lads employed on 21 farms were discovered to be accommodated in bothies; but if we leave out the east of Fife, where the system is less prevalent, it is found that almost half of the male servants are bothy-men. Unfortunately, no calculations of a similar character appear in other reports, but the following extracts may be interesting as

showing where and to what extent bothy life existed in Scotland in 1893:—

In *Aberdeen*	"A good many."
Kincardine	"Almost universal."
Forfar and East Perth	"The rule throughout the district."
Banff	"A few."
Nairn	"A good many."
Moray	"More common than in Banff."
Caithness	"Practically ceased to exist."
Orkney	"Are to be found, both for males and females."
Ross and Cromarty	"Have practically disappeared."
Ross and Inverness	"A good many."
Stirling and Dumbarton	"Fairly numerous; a few well built and comfortable; some comfortless and without repair."
Ayr, Renfrew, and Bute	"Not numerous; gradually disappearing."
North Lanark and Linlithgow	"Very rare; in the absolute form scarcely exists at all."
Wigtown, Kirkcudbright, and Dumfries	"An extinct institution."
The Lothians	"Extinct."
Fife	"Disappearing in the east; numerous elsewhere."
Kinross and Clackmannan	"Numerous."
Roxburgh and Berwick	"Unknown."
Selkirk and Peebles	"None."

Under the bothy system in its entirety the men both sleep and cook their own food in the bothy. There can be no doubt that long ago, when it was the custom to feed farm-labourers in the farmhouse, the bothy was only a resting or sleeping place; but with the downfall of the farm-kitchen system came the uprise of the present "barrack-life."

Bothies vary very much in character. In a few instances they have been specially built with a view to comfort, order, and decency; and where this has taken place and been backed up by supervision and attention on the part of the farmer, this cheap way of accommodating unmarried men may be not only justifiable but even commendable. But, on the other hand, the custom of crowding young men together like bullocks in a truck, and condemning them to live and sleep in a room which is seldom clean and never comfortable, and leaving them there unheeded and uncontrolled, cannot be defended either in theory or practice. Where farm-cottages are scarce and the unmarried servants not related to the resident families, the bothy may be a necessity; but one cannot help seeing that the evils which do and must of necessity accompany such a manner of life, might be enormously modified.

Suggestions for the Improvement of Bothies.—In those parts of

Scotland where bothies prevail, there are two things which we would respectfully urge upon public attention.

In the first place, landowners should personally visit and examine the bothies on every farm. Where there are seen to be no separate sleeping apartments, and insufficient space to make cubicles, additional space should be taken in, and the necessary night accommodation supplied. It should be a condition in every lease or form of estate agreement that the tenant shall undertake and be responsible for the regular and thorough cleaning out of properly constructed bothies, and it should be incumbent on the factor to see that the condition is duly observed.

In the second place, the tenant should, in the proper discharge of his duty, take such steps as are necessary to secure the due observance of these conditions, and he should do it not in an aggrieved or unfriendly spirit, but with kindliness and benevolence in thought, word, and action.

The bothy system has for many years been the subject of much animadversion and censure. It would be difficult to say which of the reports—1867, 1879, or 1893—is strongest in its terms of condemnation; but in one point they agree: they recognise the difficulty of altogether abolishing it; but they believe that a great deal could be done by increasing the supply of farm-cottages, to reduce the necessity for such places. Moreover, it is chiefly against "bothy life as at present conducted" that from time to time Assistant Commissioners and others have declaimed, and it rests entirely with proprietors and tenants to decide by concerted action what judgments may be passed on the custom in years to come. A very great change must be made, and doubtless outlay will be required from the landlord and exertion from the tenant, but both are imperatively called for in order to rid Scotland and Scottish agriculture of what in its present form can only be described as a *national disgrace.*

To what extent County Councils may think fit to interfere is not for me to say, but one cannot help feeling that the subject is ripe for their consideration, and one with which they will sooner or later be called upon to deal.

Proportions of Labourers, Horses, and Cottages to Acres.—The relative proportions of labourers, horses, and cottages to acres being an interesting subject to farmers, two tables, with respect to Fife, Kinross, and Clackmannan, Edinburgh and Haddington, based upon particulars collected from farmers in different localities, are herewith reproduced:—

RELATIVE PROPORTIONS OF HORSES AND LABOURERS TO ACRES.

Edinburgh and Haddington.

	Per 100 acres gross.	Per 100 acres arable.	Per 100 acres under crops.
Number of horses (exclusive of riding and driving)	2.27	2.8	3.57
Labourers, regular and constant—			
Men and strong lads . . .	2.33	2.9	2.67
Women and young boys . .	1.75	2.21	2.76
	4.08	5.11	5.43
Cottages occupied by labourers. .	2 almost	2.51	3.13

Fife, Kinross, and Clackmannan.

	Per 100 acres gross.	Per 100 acres arable.	Per 100 acres under crops.
Number of horses	2.2	2.8	4.3
Regular and constant men . .	1.69	2.14	3.28
Women and lads	1.0 almost	1.26	1.9
Men, women, and lads	2.69	3.40	5.18
Cottages	1.28	1.62	2.49

Percentage of men and lads accommodated in bothies, 36.4.

WAGES AND EARNINGS.

Different Systems of Remuneration.—In any attempts to describe the financial position of the Scottish agricultural labourer "then and now," we are hampered by the fact that, all over the country, the custom has been to pay so much in money and so much in kind. Although in the 1893 reports the Assistant Commissioners have made a point of reducing the payments in kind, perquisites, or "gains" to £ s. d. in the case of *ploughmen*, the reader has often to put up with a description rather than a valuation of the earnings of other grades of labourers.

Personally, I found no difficulty in reducing perquisites to their money value, for farmers were generally agreed upon the value of such things as meal, milk, coals, potatoes, and haulage, while the value of a free house and garden depends on the quality of the cottage, which any one can see for himself.

Moreover, it is somewhat remarkable that, as a rule, the labourers were not only prepared to accept the farmer's valuation, but disposed, if anything, to go higher.

In some of the Scotch reports the existence of cattle-men, shepherds, and ordinary labourers, in so far as they appear on the pay-sheet, is ignored altogether, whereas at other times their gains are not fully described.

The reports of 1867 to 1870, and those of 1893, supply material for the following table:—

PROPORTIONS OF MONEY AND VALUE OF PAYMENTS IN KIND TO TOTAL EARNINGS—1867-70 AND 1892-93.

Calculated from the Wages of ordinary Ploughmen.

County.	1867-70.		1892-93.		Remarks.
	Money.	Kind.	Money.	Kind.	
	%	%	%	%	
Aberdeen	53.	47.	74.8	25.2	
Ayrshire	63.	37.	72.5	27.5	
Edinburgh	67.	33.	74.0	26.0	
Elgin	60.6	39.4	64.5	35.5	
Fife	49.1	51.9	55. to 60.	40. to 45.	A strong desire for all money payments manifested in certain districts of these counties.
Forfar	60.	40.	60.	40.	
Haddington	33.	67.	76. to 82.	24. to 18.	
Inverness	50.	50.	56.7	43.3	
Kirkcudbright	50.	50.	88. to 89.	11. to 12.	Would also apply to Dumfries.
Ross	40.	60.	53.	47.	
Roxburgh and Berwick	12.2	87.8	78. to 60.	22. to 40.	
Wigtown	43.8	56.2	90. to 53.	10. to 47.	Payments in kind chiefly confined to the west side of Wigtown.

Although it is wellnigh impossible to tabulate in a comprehensive form or satisfactory manner evidence of so varied a description as that which the reports of 1867 and 1893 contain, the above table gives a good idea of what was, and is, the custom throughout a large portion of twelve counties of Scotland. Payment in kind has almost everywhere given place to money, and a weekly rate of wages has frequently been established, to the satisfaction of both employer and employed. In Haddington, about the year 1852, the "boll" wage was common, and the following specimens taken from the Lothian report,

1893, show the changes that have taken place in that county during the past forty years:—

SPECIMENS OF WAGES AND EARNINGS AT DIFFERENT PERIODS, 1852-93.

Boll Wage in 1852.

8 qrs. oats, at 28s. . .	£12	12	0
2¼ ,, barley, at 36s. .	4	1	0
1 ,, beans, at 42s. .	2	2	0
Lint and hens . .	1	1	0
Keep of a cow and pig .	6	0	0
Harvest meat . .	1	0	0
1200 yards of potatoes .	3	0	0
Free house, garden, and manure .	2	10	0
Coals carted . . .	1	0	0
	£33	6	0

Or 12s. 10d. per week.

In 1881.

Money	£24	0	0
3 bolls barley, 27s. .	4	1	0
1 ,, beans . .	1	12	0
65 stones oatmeal, at 2s. 2d.	7	0	10
1 month's harvest food .	1	0	0
1600 yards potatoes .	6	8	0
House and garden . .	4	0	0
	£48	1	10

Or 18s. 6d. per week.

In 1867 *Mr Culley reports a Mixed Wage in East Lothian.*

Money	£14	0	0
Cottage and garden free	3	0	0
Carriage of coals, say .	0	15	0
Cow's keep (3s. per week)	7	16	0
65 stones oatmeal . .	6	10	0
12 bushels barley . .	2	14	0
4 ,, beans . .	1	0	0
1000 yards potatoes .	5	4	0
4 weeks' harvest food .	0	18	0
Straw for pig-sty . .	0	10	0
	£42	7	0

Or 16s. 3½d. per week.

In 1893.

Cash, 16s. per week .	£41	12	0
Free house and garden .	5	0	0
Manure for garden .	0	6	0
16 cwt. potatoes, at 3s. .	2	8	0
Coals carted	0	10	0
Harvest	1	5	0
	£51	1	0

Or 19s. 7¾d. per week.

In other parts of Scotland a gradual change similar to that described above has been going on.

The next table (pp. 264, 265) shows the total annual wages and earnings of a married ploughman for the three periods 1867, 1879, 1893, in every county of Scotland where tillage is prosecuted to any extent. The figures apply to ordinary regular servants, as distinct from ploughmen-stewards or foremen. Where several quotations were given from one county an average has been struck between maximum and minimum. The absence of any returns from several counties in the earlier reports detracts from the value of the table, but even in its incomplete form it gives the reader a good idea of the rise in the value of agricultural labour. The twenty-six years, 1867-93, might with perfect truth have been divided into two periods of thirteen years each, 1867-80 and 1880-93, for the Richmond Commission lasted from 1879 to 1882, and the Assistant Commissioners were employed most of the time.

Wages and Earnings long ago.—But we are in a position to trace wages and earnings further back than 1867, for in the reports made in that year numerous references are made to the rise that had taken place during different periods prior to that inquiry.

Forfarshire—Between 1852 and 1867 wages and earnings increased from £30 to £38, 6s. 8d. The average in 1893 was £50, an increase of £20, or 66.6 per cent in forty-one years.

Perthshire—From £36, 19s. in 1864 to £49, 15s. 11d. in 1893, being an increase of £12, 16s. 11d., or 34.7 per cent in twenty-nine years.

Dumfries—Mr Tremenheere's table shows an increase of from 43 to 71 per cent between 1840 and 1870. An average ploughman's wage in 1840 was £26, and this, compared with £46 in 1893, indicates a rise of £20, or 77 per cent in fifty-three years.

Ayrshire—In 1855 an average wage was £28. In 1893, £50, 16s. Increase, £22, 16s., or 81 per cent in thirty-eight years.

Caithness—In 1830, £20 was considered more than an average ploughman's wage. In 1893, £36. Increase, £16, or 80 per cent in sixty-three years.

Banff—

Evidence from one farm.	1843	£12	12	0,	with food at	5s.	per week	. £25	12	0
	1853	18	0	0	"	5s.	"	. 31	0	0
	1863	26	0	0	"	6s.	"	. 41	12	0
	1873	27	0	0	"	7s.	"	. 45	4	0
	1881	31	0	0	"	8s.	"	. 51	16	0
	1893	No record of farm-kitchen system.								

Increase, 1843–81 = £26, 4s., or 102 per cent in thirty-eight years.

In 1893, under the farm-cottage system, a ploughman's wage and earnings is stated to be £45. This is an increase of £19, 8s., or 75.7 per cent in fifty years.

Approximate Increase during Forty-five Years.—Putting these six comparisons together, we are led to conclude that during the last 45 years the Scotch ploughman's earnings have increased about 69 per cent. It should, however, be pointed out that the low price of meal and potatoes has diminished the estimated value of perquisites for the year 1893, and in so doing has considerably neutralised the rise in money wage; while, on the other hand, a free house and garden being valued at a larger figure now than formerly, has operated in the other direction.

Wages of Labourers other than Ploughmen.—The wages of cattle-men and constantly employed resident labourers closely correspond with those of ploughmen, and in many of the reports there is no calculation of their earnings other than that which

TABLE showing the estimated average Annual Wages and Earnings of a Married Resident ordinary Ploughman in each County in Scotland, in the years 1867, 1879, 1893, with increases or decreases during 26 intervening years.

Abbreviations—N.R. = no returns; N.C. = no change.

Group of Counties.	Name of County.	Estimated Average Annual Wage and Earnings.			Increase or Decrease per cent.			Average Increase per cent, calculated by Groups of Counties.		
		1867.	1879.	1893.	1879–67.	1893–79.	1893–67.	1879–67.	1893–79.	1893–67.
		£ s. d.	£ s. d.	£ s. d.						
Northern	Caithness	34 0 0	40 0 0	36 0 0	+17.6	−10.0	+5.8	...	...	...
	Inverness	30 0 0	N.R.	46 2 6	...	...	+53.7	...	...	...
	Ross and Cromarty . .	36 11 4	41 0 0	42 10 0	+12.1	+3.6	+16.2	...	...	...
	Sutherland	N.R.	40 0 0	42 10 0	...	+6.2	...	... 14.85	... N.C.	... 25.2
North-eastern . . .	Aberdeen	32 17 4	45 0 0	45 10 0	+36.9	+1.1	+38.4	...	...	...
	Elgin and Nairn . . .	31 8 0	N.R.	45 0 0	...	...	+43.3	...	...	...
	Forfar	38 6 8	48 0 0	50 0 0	+25.2	+4.1	+30.4	...	...	...
	Kincardine	N.R.	48 0 0	49 15 0	...	+3.6	...	... 31.05	... 2.9	... 37.3
Central . .	Clackmannan . . .	N.R.	N.R.	49 6 11	...	...	...	...	...	...
	Fife	38 12 7	N.R.	50 1 3	...	...	+29.6	...	...	...

Central—*continued* . .	Kinross	N.R.	N.R.	46 6 10	...	...	...	...	...	...
	Perth	38 4 0	44 0 0	49 15 11	+15.1	+13.1	+30.3	...	...	...
	Stirling and Dumbarton .	N.R.	N.R.	52 14 3	...	...	...	...	...	...
								Insufficient		data.
Wester	Argyle and Bute . . .	35 10 0	39 0 0	50 0 0	+ 9.8	+28.2	+40.8	...	...	...
	Ayr	38 0 0	43 0 0	50 16 0	+13.1	+18.1	+33.6	...	...	...
	Lanark	46 0 0	49 0 0	55 0 0	+ 6.5	+12.2	+19.5	...	...	...
	Peebles	39 5 0	48 10 0	47 9 0	+23.5	−2.1	+20.8	...	...	...
	Renfrew	N.R.	N.R.	59 7 0	...	...	...	...	...	...
								13.2	14.1	28.67
South-eastern . . .	Berwick and Roxburgh .	40 16 0	48 10 0	50 0 0	+18.8	+3.0	+22.5	...	...	...
	Edinburgh and Linlithgow .	39 5 6	49 10 0	51 7 6	+26.0	+3.7	+30.8	...	...	...
	Haddington	42 7 0	48 2 0	51 0 0	+13.5	+6.0	+20.4	...	...	...
	Selkirk	37 0 0	47 0 0	46 0 0	+27.0	−2.1	+24.3	...	...	...
								21.3	2.65	24.5
South-western . . .	Dumfries	38 0 0	45 0 0	46 0 0	+18.4	+2.2	+21.0	...	...	...
	Kirkcudbright . . .	34 0 0	N.R.	44 3 0	...	...	+29.8	...	...	...
	Wigtown	32 0 0	40 0 0	43 0 0	+25.0	+7.5	+34.3	...	...	...
								21.7	4.85	28.36
			SCOTLAND (excluding Central Counties)					20.42	6.12	28.80

has been related of ploughmen and stated to apply to other classes of men. Sometimes shepherds are placed on the same footing, but more frequently some distinction is drawn between ploughmen and shepherds. As a rule, it is only in districts where breeding flocks are kept that regular and trained herds are found, and there the wages vary so much that the striking of an average would convey little or no information to the reader.

In 1867 and 1879 no special reports were made upon pastoral districts; so the wages as ascertained in 1893 to be common among the Perth, Argyle, Inverness, Ross, Selkirk, Peebles, and Dumfries hills find no parallels in past blue-books. Figures do appear for four counties in each of the reports, and although they require explanations beyond my power to give, I register them:—

SHEPHERDS' WAGES AND EARNINGS.

COUNTY.	1867.	1879.	1893.
Argyle	£35 5 10	£46 19 0	£44 19 0
Dumfries	47 10 0	52 0 0	£49 to 62
Haddington	43 0 0	£52 to 100	56 to 76
Peebles	51 10 0	49 to 56	49 to 62

It may be said that the present wages and earnings of a married shepherd in the Highlands run from £50 to £58, 10s. Head shepherds, £60 to £80. Junior shepherds, £35 to £46. Temporary shepherds, frequently employed with turniping hoggs, 17s. to 21s. per week. Lambing assistants, 25s. to 29s. per week. Among the Lowther and Lead hills junior herds from £42 to £50 a-year; experienced lambing assistants, 30s. to 35s. a-week, with board; young hands, 17s. to 20s. a-week, with board.

Wages of Females.—Coming to the wages of women-workers, we find material in the three reports for a fairly complete table (pp. 268, 269). I have again taken the average in cases where different wages have been supplied from the same county, and instead of quoting day-wages, have given them by the week. Harvest wages are put by themselves, and where special pay is allowed at potato-lifting the fact is stated in "Remarks."

CONCLUDING REMARKS UPON THE PRESENT CONDITION OF THE AGRICULTURAL LABOURER.

There are many other subjects in connection with agricultural employment in the past and present which might be referred to in

this paper, but space will not permit. A few lines, in conclusion, upon the general condition of the labourer as it was and is must bring this contribution to a close.

Although for a year or two, about 1874 to 1877, farm wages were probably as high as they were last year, there can be no doubt that the general condition of the labourer is better now than it ever was before. His wages have not suffered by reason of agricultural depression, and he is deriving full benefit from the fall in prices of groceries, flour, meal, bread, and butcher's meat. His family are educated by the State, and for those who excel as scholars there are opportunities for employment in progressive situations to which the country lad of forty years ago dared hardly aspire. This opening up of new fields of employment in recent years has prevented any superfluity of rural labourers, and it has probably been the chief factor in maintaining farm wages in the face of falling rents and decreasing prices.

The Scotch farm-labourer is well housed, constantly employed, paid whether sick or well, has a holiday now and then without losing his wages, his hours are distinctly shortened, and his work undoubtedly lighter. Mr Wilkinson, in his Berwick and Roxburgh report, writes: "I have no hesitation in saying that the agricultural labourer in this district is well off both comparatively and positively. I think the common phrase, 'The hind is the best off of all that have to do with the land,' is no exaggeration. His position, in my opinion, is far superior to that of the ordinary artisan, and to that of many a city clerk."

The same might be said of Scotland generally. "Comfort is written both within and outside the labourer's cottage." Writing twenty-six years ago, Mr Tremenheere tells the Commission on the Employment of Children, Young Persons, and Women in Agriculture, that, in Dumfriesshire, "Married men who live in cottages seldom taste animal food. . . . Although their cottages are substantially built, warm, and well ventilated, they lead a hard life; their meals being usually chiefly tea or coffee, with bread or oilcake" (? oatcake.—R. H. P.). In Kirkcudbright the labourers were said to "live chiefly on porridge, and it is seldom they are able to buy a bit of butcher's meat." From Ayrshire we learn, "Formerly meal and potatoes constituted their only food." And the Commissioners in their report state that "except in the cases where the hinds are boarded with the farmer on the old kitchen system, butcher's meat appears to be rarely at their command."

It is apparent, from the exhaustive statements made by the Assistant Commissioners of 1893, that at the present time butcher's meat is much used by our labourers as an article of

TABLE SHOWING THE AVERAGE WEEKLY WAGE OF A WOMAN-WORKER (REGULARLY EMPLOYED) IN EACH COUNTY OF SCOTLAND, IN THE YEARS 1867, 1879, 1893.

Abbreviations — N.R. = no returns; N.C. = no change.

County.	Rate of Wage per Week. 1867. Ordinary.	1867. Harvest.	1879. Ordinary.	1879. Harvest.	1893. Ordinary.	1893. Harvest.	Remarks.	Increase or Decrease per cent. 1879–67. Ordinary.	1879–67. Harvest.	1893–79. Ordinary.	1893–79. Harvest.	1893–67. Ordinary.	1893–67. Harvest.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.							
Aberdeen . .	6 0	20 0	7 6	22 6	9 0	N.R.	1893. No harvest wage stated	+25.	+12.5	+20.	...	+50.	...
Argyle . . .	5 0	12 0	6 0	12 0	N.R.	N.R.	1879. Food probably given in harvest	+20.	N.C.	...	...	...	...
Ayrshire . . .	6 0	15 0	7 6	15 0	9 0	N.R.	1879. Potato-lifting 2s. per day	+25.	N.C.	+20.	...	+50.	...
Banff . . .	6 0	20 0	7 6	15 0	7 6	22 0	1893. £1 for harvest food	+25.	−25.	N.C.	+46.6	+25.	+10.
Berwick . . .	7 0	20 0	9 0	20 0	10 0	15 0	...	+28.5	N.C.	+11.1	−25.	+42.8	−25.
Caithness . .	N.R.	N.R.	6 6	N.R.	7 6	15 0	...	...	...	+15.3	...	...	...
Clackmannan . .	N.R.	N.R.	N.R.	N.R.	9 0	21 0	1893. Potato-lifting 12s. per week	...	...	...	...	...	...
Dumbarton . .	N.R.	N.R.	N.R.	N.R.	9 0	21 0	1893. Potato-lifting 12s. per week	...	...	...	...	...	...
Dumfries . .	6 6	15 0	9 0	18 0	9 0	18 0	...	+38.4	+20.	N.C.	...	+38.4	+20.
Edinburgh . .	7 0	21 0	8 6	15 0	8 6	13 6	1893. Potato-lifting 12s. per week	+21.4	−28.5	N.C.	−10.	+21.4	−35.7

Elgin . . .	5	0	N.R.		7	6	15	0	7	6	22	0		...	+50.0	...	N.C.	+46.6	+50.0	...
Fife . . .	6	0	18	0	N.R.		N.R.		8	3	18	0	1893.	Potato-lifting 12s. per week	...	...	...	...	+37.5	N.C.
Forfar . . .	6	0	18	0	N.R.		N.R.		8	3	24	0	1893.	Potato-lifting 12s. per week	...	...	...	...	+37.5	+33.3
Haddington . .	6	0	15	0	9	0	13	6	9	0	16	0	1893.	Potato-lifting 12s. per week	+50.0	−10.0	N.C.	+18.5	+50.0	+ 6.6
Inverness . .	4	6	9	0	N.R.		N.R.		7	6	15	0		...	...	...	...	...	+66.6	+66.6
Kincardine . .	N.R.		N.R.		7	6	20	0	9	0	N.R.			...	...	...	+20.0	...	...	...
Kinross . . .	N.R.		N.R.		N.R.		N.R.		7	0	18	0	1893.	Potato-lifting 12s. per week	...	...	...	...	...	...
Kirkcudbright .	N.R.		N.R.		N.R.		N.R.		8	0	15	0		...	...	...	...	...	...	...
Lanark . . .	7	6	15	0	9	0	N.R.		9	0	18	0		...	+20.0	...	N.C.	...	+20.0	+20.0
Linlithgow . .	7	0	21	0	7	6	15	0	8	0	14	0		...	+ 7.1	−28.5	+ 6.6	− 6.6	+14.2	−33.3
Nairn . . .	5	0	9	0	7	6	15	0	7	6	22	0		...	+50.0	+66.6	N.C.	+46.6	+50.0	+144.4
Peebles . . .	7	6	N.R.		10	0	N.R.		N.R.		N.R.			...	+33.3	...	...	...	...	...
Perth . . .	6	0	15	0	7	6	18	0	8	0	24	0	1867. 1893.	Turnip-singling 9s. Potato-lifting 12s. per week	+25.0	+20.0	+ 6.6	+33.3	+33.3	+60.0
Renfrew . . .	8	0	N.R.		9	0	18	0	12	0	21	0	1879. 1893.	Near towns a higher wage Hay-making 2s. 6d. per day	+12.5	...	+33.3	+16.6	+50.0	...
Ross and Cromarty	4	0	9	0	7	0	N.R.		7	6	15	0		...	+75.0	...	+ 7.1	...	+87.5	+66.6
Roxburgh . .	7	0	20	0	9	0	20	0	10	0	15	0		...	+28.5	N.C.	+11.1	−25.0	+42.8	−25.0
Selkirk . . .	N.R.		N.R.		9	0	16	0	N.R.		N.R.			...	...	...	...	...	...	...
Stirling . . .	7	6	15	0	N.R.		N.R.		9	0	21	0		...	...	...	...	...	+20.0	+40.0
Sutherland . .	N.R.		N.R.		6	6	N.R.		7	6	15	0		...	...	...	+15.3	...	...	...
Wigtown . .	N.R.		N.R.		7	6	15	0	8	0	15	0		...	...	...	+ 6.6	N.C.	...	...

food, and meal and potatoes only regarded as auxiliaries to more substantial dishes.

Employers as a whole are of opinion that this change in diet has caused a deterioration in the physique and stamina of the men, and although it is not easy to understand why or how better food should act in this way, still there is every reason to believe that the farmer got more work for less wages in the good old days of yore.

The conclusions arrived at by the Assistant Commissioners in 1870 and 1893 are in complete accord with regard to thrift, prudence, and saving among our farm-labourers. The great increase in wages and general improvement in other things have not been accompanied by any endeavours to lay by money or anticipate old age. The fact of more money coming in only means more money going out in the case of 75 per cent of our labourers. The few who deny themselves luxuries in ordinary everyday life, can and do save; but the same took place on the miserable earnings of forty years ago. A witness in 1879 said, "The increased wage is either spent in dress or on food." Another observes, "As wages increase, outlay does the same."

For too many of our labourers' wives debt has no terror, and to the unfortunate habit of falling into arrears with grocers and merchants, many of the flittings from good cottages and excellent situations must be attributed.

Neither could we say, with the reports before us, that the farm-servant of 1893 is everywhere a contented individual. In counties far away from competing industries the spirit and disposition of the hind are on the whole satisfactory, and between master and man the relations are cordial; but the proximity of trade centres, mines, or mills, seems to have in a large measure upset the equilibrium of the country labourer, and given rise to suspicions which are groundless and expectations which cannot be realised.

The spread of labourers' unions in Scotland has not met with the general assistance or approval of good farm-servants, and the common-sense of the parents will for some years to come help to strengthen the intentions of the children to continue faithful and true to their masters, and leave agitation and sedition to those whose trade and profession it is to stir them up.

What changes of legislation the recommendation of the Royal Labour Commission of 1892-93 may bring to pass we have at present no means of knowing, but I trust that in the foregoing pages some proof has been given of the steady advance made by the farm-labourer of Scotland within the last forty years, and some light thrown upon the intellects of those who continually

talk about the grievances of the employed, but ignore the disasters which have befallen the employer.

The events of the last twelve years of British agriculture, a history of which will no doubt be laid before the public by the Commission upon Agricultural Depression now sitting, will, I suspect, form a very strange contrast to the reports which have emanated from the Labour Commission. A comparison of the two will doubtless prove to the most prejudiced mind that, in Scotland at any rate, the farm-labourer has indeed a goodly heritage, and that instead of being an overworked and underpaid man, he is in reality the child of good fortune.

SCOTCH SHORTHORNS.

By Robert Bruce, Darlington.

Never before in the history of the shorthorn breed has any family or strain of blood attained such a position as that at present held by the cattle known as Scotch shorthorns.

For years at the breeding and fat stock shows in England Scotch shorthorns have taken a large proportion of the prizes, and in the year just passed the merits of this strain of blood have asserted themselves both at home and abroad in the strongest manner possible.

At the great World's Fair at Chicago, almost the entire amount of money offered as prizes for shorthorns was gained by animals of direct Scotch descent, and the great sweepstake prize for the best male animal in all the cattle classes was won by a bull bred in Canada of pure Sittyton blood. Such a record as that made at the great American gathering must have drawn public attention to the Scotch cattle; but their doings at the principal breeding and fat shows in England during the past few years had in a large measure prepared the minds of breeders for what might be expected at Chicago.

Here it may not be out of place to give a short summary of the doings of the Scotch shorthorns, during the past five years, at the Smithfield shows in the steers and heifer classes.

Smithfield Show.

1889. Steers under 2. One of Scotch breeding entered; result, 1st prize.
Steers under 3. Three of Scotch breeding entered; result, 1st and 2d prizes.
Steers under 4. Two of Scotch breeding entered; result, 1st prize,

the breed cup, the cup for best steer in the show, and the champion cup as the best animal in the show.

Heifers under 4. One of Scotch breeding entered; result, 1st prize.

1890. Steers under 2. One by a Scotch bull entered; result, 1st prize.

Steers under 3. Three of Scotch breeding entered; result, 1st, 2d, and 3d prizes.

Steers under 4. Two of Scotch breeding entered; result, 2d and 3d prizes.

Heifers under 4. Two of Scotch breeding entered; result, 1st prize, the breed cup, the cup for best female in the show, and the champion cup as best animal in the show.

1891. Steers under 2. One of Scotch breeding entered; result, no prize.

Steers under 3. Two entered, one of Scotch breeding being 1st, and taking the breed cup; the other, by Scotch bull, taking 2d prize.

Steers under 4. One of Scotch breeding entered; result, 2d prize.

Heifers under 3. One by a Scotch bull and one of Scotch breeding being entered; result, 1st prize, and cup for best female in the show, for former, and 3d for latter.

1892. Steers under 2. Two of Scotch breeding and two by Scotch bulls being entered; result, 1st, 2d, and 3d prizes, and reserved number.

Steers under 3. Four Scotch bred and one by a Scotch sire entered; result, 1st and 2d prizes, and reserved number.

Steers under 4. One Scotch bred and one by a Scotch sire entered; result, 1st prize and reserved number.

Heifers under 3. One by a Scotch bull and two Scotch bred were entered; result, the former, 1st, the breed cup and reserved number for best female animal in the show; the others took 2d prize and reserved number.

1893. Steers under 2. Two by Scotch bulls and one of Scotch breeding entered; result, 1st and 3d prizes and reserved number.

Steers under 3. Five Scotch bred and three by Scotch bulls entered; result, 1st, 2d, and 3d prizes and reserved number.

Steers under 4. Two Scotch bred and one by a Scotch bull entered; result, 1st prize, breed cup, cup for best steer in the show, and the reserved number for the best animal in the show.

Heifers under 3. Three Scotch bred and one by a bull of Scotch breeding entered; result, 1st and 2d prizes.

To summarise the above, we find that the winnings of Scotch cattle were as follows:—

1889. All the 1st prizes and championship of the show.

1890. Three out of four 1st prizes and championship of the show.

1891. Two out of four 1st prizes, the breed cup, and cup as best female animal in the show.

1892. All the 1st prizes and the reserved number for the best female animal in the show.

1893. All the 1st prizes, the cup for the best steer, and reserved number for the best animal in the show.

If we turn, on the other hand, to the winnings of the Scotch shorthorn bulls at the five past shows of the Royal Agricultural Society of England, we find they, or animals got by Scotch-bred

sires, have taken a very prominent position, as this brief summary will show.

Royal Agricultural Society.

1889. Old bulls, 1st and 3d prizes.
Three-year-old bulls, 3d prize.
Two-year-old bulls, 3d prize.
One-year-old bulls, 1st prize.
1890. Old bulls, 1st prize.
Two-year-old bulls, 1st prize and championship.
One-year-old bulls, 1st prize.
1891. Two-year-old bulls, 2d prize.
1892. Old bulls, 1st, 2d, 3d prizes, and championship.
Two-year-old bulls, 1st prize.
One-year-old bulls, reserved number.
1893. Old bulls, 1st, 2d, 3d prizes, and championship.
Two-year-old bulls, 2d and 3d prizes.
One-year-old bulls, 2d prize.

These particulars are interesting, more especially if we reflect that until of late years Scotch bulls seldom figured in the Royal English Show prize-lists, few having been entered. Let us therefore consider *what has brought about the change.* We do this under the two following heads:—

1st, There has been a temporary falling off in English shorthorns in the properties of practical usefulness.

2d, In Scotch shorthorns practical usefulness has evidently been the aim and object steadily kept in view by the breeders.

Before we approach these two points it is absolutely necessary to say that we speak of the English shorthorns in broad, general terms. We are quite alive to the fact, and with pleasure acknowledge, that several English herds have been bred in a way altogether different from the too common system which has worked such mischief and caused so much loss.

To the owners of these herds the whole of the shorthorn breeders are indebted, and, judging from their actions in the past, there can be no doubt but before long we shall see a blending of this now almost invaluable English blood with that of the robust, thrifty, though perhaps less finished-looking, cattle of the far north-east.

The Collings.

It will be necessary to consider the subject of the deterioration in the matter of practical usefulness in the English shorthorns at some length, and this can only be done by taking a short survey of the doings of Southern breeders since the days of the Collings.

This may be taken as a starting-point, as the Collings are looked upon as the fathers of the breed. The herds belonging

to the two brothers were sold—the one in 1810, when 29 females averaged £140, 4s. 7d., and 18 bulls and calves £169, 8s.; and the other in 1818, when 51 cows and heifers averaged £111, 13s., and 10 bulls and calves £215, 17s. 7d. The prices realised at these sales created quite a sensation in the cattle-breeding world, and led to the spread of the shorthorn breed of cattle throughout the length and breadth of the kingdom. From the time of the final dispersion of the two herds at Ketton and Barmpton till the inauguration of the Royal Agricultural Society of England, there is little to refer to connected with the breed, although doubtless many herds earned more than a local reputation.

Booth and Bates.

The prizes offered by the Royal English Society, and *éclat* attached to the winning of such honours, did much to bring the herds of successful exhibitors prominently before the public. Two Yorkshire breeders exhibiting two rather distinct types of animals became nationally famous through the position their animals took at the great show meetings, and considerable rivalry was the consequence.

Men have different ideals of perfection in animals, and it is well that such should be the case. But it is here we find the first indications of the error which afterwards came to be almost generally diffused throughout the whole of England. The error we refer to was the belief that the whole of the shorthorn cattle had to be classed under two, and only two, sorts—viz., the Booth and the Bates.

Looking back over a period of fifty years and more, we can fancy we see the two rival types. We can see the thick-fleshed, short-legged, wide-chested Booth cattle of a sort to spread thrift and goodness as meat-producers amongst the ordinary herds of the country. We can also fancy we see the Kirkleavington cattle with their freer movement and greater style of carriage, the udders of the cows showing evidence that dairy properties were qualifications especially attended to.

There can be no doubt but that these two strains of shorthorns were really superior cattle, that they were brought out and carefully bred by men who were born breeders, and that the influence of their herds was felt throughout the whole shorthorn world. The position taken by the Kirkleavington cattle at the earlier meetings of the Royal English Society seems to have attracted the attention of the American breeders, and from what we know of Thomas Bates he was eminently the man to take full advantage of popularity so earned. Possessed of a strongly prejudiced disposition, he

did not hesitate to affirm that his cattle were better than those in any other herd, and it has been put on record he asserted that the future of the herd depended upon the life or death of a particular calf at Kirkleavington. At the very time such a statement was made, the cattle from Killerly and Warlaby were carrying almost everything before them at the great show meetings, and were being quite as carefully bred as his own.

We cannot fail to acknowledge the greatness of Thomas Bates, nor his ability as a breeder. This is shown clearly in the fresh strains of blood he introduced into his herd from sources entirely outside the charmed circle of what was then looked upon as of fashionable blood. To be sure, he no sooner used an outside cross of any description than he canonised it, so to speak—having discovered to his own satisfaction qualifications both in the breeding and the individuals hitherto unknown and undreamt of. And here it may be said that both in the Bates and Booth herds outside blood was systematically brought in; and this bringing in of fresh blood, combined with the method of line-breeding generally pursued, was doubtless the great secret of the success of both strains.

At the death of Thomas Bates the herd at Kirkleavington was dispersed in 1850, when an average of nearly £54 was made for 69 animals, and quite a number of the best of the cattle were bought by Earl Ducie, a nobleman who was a decided enthusiast as a breeder. Much has been said and written as to the cattle sold at the Kirkleavington sale. We fully acknowledge that they were good cattle, and cattle possessed of certain very striking qualifications. Compared, however, with the Booth cattle of their day, they lacked that thickness of substance and wealth of flesh so prized by breeders; and we have the authority of Mr Cruickshank, Sittyton, who attended the sale, for saying that beyond being good cattle there was nothing to excite his admiration so as to induce him to spend much money. A Waterloo female was the only animal he bought.

A very few years after the Kirkleavington sale the death of Earl Ducie again brought the cattle on the market, and, as we understand, the determination of an Englishman to prevent the Duchess family being taken *en bloc* by American buyers, made prices quite sensational, 62 head averaging about £151 each.

From the time of this sale at Tortworth in 1853 may be dated the extraordinary run that was made upon cattle of Bates blood. There was a widespread feeling in America that these cattle were the pure, and only pure, strains of shorthorn blood, and for a time nothing else was of value in the States. This craze—it cannot be termed anything else—culminated in the New

York Mills sale in 1873, when 15 animals of the Duchess family averaged £3679, 18s. each. Six of the higher-priced animals were bought by English breeders at an average of over £5000 each.

It seemed to become an axiom in the belief of such buyers and traders in Bates cattle, that to be valuable these animals had to be what they termed straight-bred.

To be of the greatest value they had to be bred without an out-cross from the time they left Kirkleavington; anything in the pedigrees prior to that time was at once accepted as orthodox. Such proceedings amongst Bates cattle had its natural effect upon all line-bred stock, and breeders of Booth cattle followed suit in the matter of pedigree buying and breeding. We are all ready now to blame breeders for pursuing such a course as they did, but only those who took part in the fray can understand how much that is seductive and captivating there is in breeding by pedigree and for pedigree.

It only needed an occasion to show to the world that the Booth stock were as valuable as the Bates, and this occurred when, at the death of the late William Torr of Aylesby, his herd was put upon the market in 1875. As it happened, the fortunes of the Warlaby herd were at that time very low. Through repeated attacks of foot-and-mouth disease, the herd at Warlaby had dwindled till its numbers were few and its prospects dark indeed. The sale of some of the old Booth families at Aylesby was fixed upon as an occasion to increase the numbers at Warlaby, and 12 animals were bought at an average over £1000 each. To the loss of the whole shorthorn world, and the distress of his many friends, the late Thomas Booth did not long survive to watch over the interests of the herd he had bought with so much spirit and judgment, to again stock the pastures and fill the stalls at Warlaby. He died on 7th September 1878. Had he been spared, many will join with us in saying his judgment and ability would have done much to help shorthorns in the rather trying times which followed the sensational high prices of 1875.

The Pedigree Craze.

For several years before 1875, prices had been steadily mounting upwards. It became a fashionable pastime with many members of the nobility and moneyed men to breed shorthorns, and shorthorns of a certain class. To belong to this class meant the possession of pedigrees either of Bates or Booth blood, and animals having these pedigrees commanded high prices. We find, for instance, that, in 1874, 55 animals were sold by Earl Bective at an average of £363, 4s. 6d., and 43 by the Duke of

Devonshire to average £383, 13s. 3d. In 1875, 39 were sold by the Earl of Dunmore to average £672, 8s.; and at the dispersion of the Aylesby herd at William Torr's death, 84 cattle averaged £510, 19s.

Need it be wondered at that breeders aimed at having animals of kindred blood to those worth such high prices when put on the market? Whether men leant to the Booth or the Bates cattle, every effort was made to enhance the value of their herds by the introduction of highly bred females and by the use of sires of "straight" blood.

From the time these cattle became valuable on the market may be dated the decline of their usefulness. It was evidently not a matter of the first importance for breeders to aim at having their animals of high individual merit: to be of any value they had to be bred so that their pedigrees read "straight," or as near "straight" as possible. Many old and valuable herds were sold, and lost to the country, the owners finding little market for their young stock, seeing they wanted the pedigree qualification, at that time essential to ensure buyers. As evidence of the folly of the pedigree craze and the decline of usefulness in the breed generally, shorthorns came to be no longer farmers' cattle in districts where they had been such in the fullest sense of the word for many years. This was proof positive of their decline. One point must here be noticed, as it had much to do with the loss of favour of high-bred bulls by the ordinary farmers. Before men ran riot upon pedigrees, and when herds of more directly straight-breeding were composed, as a rule, of good individuals, ordinary farmers used, because they could obtain them at reasonable prices, bulls from those herds that were short of the general excellence of their parent stocks. Such bulls, although perhaps plain looking in themselves, yet being bred from good animals, proved good sires.

The case was altogether altered, however, when inferior-looking bulls, the sons of inferior-looking parents, were sold as sires amongst the farmers. Being closely bred, and bred from parents having lost the qualifications so necessary in rent-paying cattle, they soon fell into disfavour. They were spoken of as unable to stand hardship, as deficient in flesh, and as unprofitable for dairy herds. As evidence that men believed this, the giving up of breeding stocks, and the return to the use of bulls of nondescript breeding, were circumstances too common to need more than a passing notice.

Farmers would not have, nor could they be induced to return to, the use of highly bred bulls; dairymen would not use them, and butchers scoffed at a system of breeding which aimed at producing fat animals with but little flesh.

In short, the whole system of what was termed high-class

breeding operated against the general production of shorthorn cattle full of practical utility.

Scotch Shorthorns.

We have stated that practical utility seems to have been the aim of the Scotch breeders. For this there appears to us to have been good and sufficient reasons. If the matter is looked into, it will be found that many, and indeed most, of those north-country breeders that have done much for the breed were tenant-farmers who had to depend upon their cattle for their livelihood. They pursued their calling in a country where farmers made cattle breeding and feeding the main source of income. They had to produce a class of bulls likely to get steers to feed quickly and die full of lean marketable flesh. That they succeeded in this is quite beyond question, and a short survey of what may be justly termed the parent herd will suffice to make the matter clear as to how Scotch shorthorns originated and how they have been bred.

The Sittyton Herd.

We need scarcely say that the Sittyton herd is the one to which we refer. Volumes might be written of the doings of Amos Cruickshank, and then much would be left untold. Every one who has been privileged to know this great and able man knows his innate modesty. Had he possessed this lovable and rare disposition in a less degree, his great work and its wide-spreading influences would have been earlier acknowledged, and the final reward, from a money point of view, substantial as it was, might have been infinitely greater.

There is no intention in this article to enter into particulars of the breeding or details as to pedigrees of the animals selected to start the Sittyton herd. Then, in 1837, and afterwards in all the purchases made, it may be stated, on the authority of Mr Cruickshank himself, that constitution, substance, and quality were three essential points looked for in both bulls and cows. After these were put symmetry, and in the cows a fair appearance of milk, as this indicated not only direct usefulness, but a disposition to more regular and continued breeding. It is needless to say that the original cows were selected from herds of acknowledged purity; and, as we have indicated above, there was at the date the herd was formed comparatively little known of the two great rival herds which afterwards came to be looked upon as the two, and only two, fountainheads from whence anything that was good in shorthorns could be drawn.

The first cow purchased for Sittyton was one named Countess.

She was of Mason of Chilton blood, and bought near Stockton-on-Tees. To-day it would be a matter of little trouble or expense to get an animal from Stockton to Aberdeen, but in those days when Countess was bought we can fancy the trouble of getting such an animal to her new home. In the words of Mr Cruickshank, "Subsequent purchases, which ultimately became the foundations of families established in the herd, were:—

1840. Five heifers bought in Lincolnshire from Mr Smith, one of which was the ancestress of the Violets.
1841. One heifer from M'Kennie of Kimblethmont (Venus).
One heifer from Mr Walker, Wester Fintray (Peeress).
1844. Two cows, Broadhooks, from Mr Ferguson Simpson, Mains of Pitfour.
Five cows and heifers from Mr Cartwright's sale at Tathwell, Louth, Lincolnshire (amongst others the Nonpareils).
One cow from Mr Pollock, Ireland (Lady Sarah 2d).
1847. Five cows and heifers from Mr Holmes, Ireland; two of the Victoria family.
1853. Seven cows and heifers from Mr Hutchison, Monyruy.
One heifer from Mr Dudding, Lincolnshire.
1854. The Brawith Bud sort from Mr Grant Duff of Eden.
Three cows and heifers from Mr Wilkinson of Lenton, Notts.
Sympathy (the Secret sort) from Mr Tanqueray.
Chance (afterwards the Duchess of Gloster sort) from Mr Robinson.
One cow from Colonel Townley; two cows from Mr Wood, near Darlington.

Several more were bought, but gradually many were weeded out again."

In this list just received from Mr Cruickshank, he has overlooked the purchase of Clipper from Mr Boswell, Kingcausie, in 1852. Clipper was the ancestress of a family from which several of the stock-bulls were bred.

The purchase of Avalanche, bred by Mr Dudding, in 1859, has also been omitted. From this cow came the dam of Field-Marshal (47,870), and the grand-dam of the great American bull Young Abbottsburn.

Such is the brief and very incomplete indication of the kind and sort of females with which the Sittyton herd was built up.

Good as the females were that were bought, and any one knowing Mr Cruickshank will accord him credit for giving each purchase careful and due consideration, the sires brought into the herd during the earlier years of its existence deserve especial attention.

We know that, for a long series of years, the best bulls to be found in England were bought; money was freely spent whenever and wherever bulls to please Mr Cruickshank could be bought. These bulls were bought not because they were of any particular strain of blood or family, but on account of their individual merits; while all the time the quality and

kind of stock from whence they came received the most careful attention.

We find that the first bull used at Sittyton was Sovereign (7539), bred by Captain Barclay of Ury; and the first bull sold was Young Sovereign (7541), calved in 1841, and bought by Mr Mitchell, Auchnagathle, Keig, at £35.

During the first nine years of the herd's existence—1838 to to 1846—four bulls used were of Captain Barclay's breeding. They were Sovereign (7539), Inkhorn (6091), Premier (6308), and Conqueror (6884); and during the same time the bull The Touches (6596), bred by the Duke of Buccleuch, was also in service.

In 1847, 1848, and 1849, Fairfax Royal (6987), bred by Mr Torr, Aylesby, was in service, and did much good in the herd. Mr Cruickshank to this day speaks of Fairfax Royal as one of the best-looking bulls ever used at Sittyton.

Without attempting to give a full list of the sires at Sittyton until the time that the herd became self-sustaining (about 1872), it may be interesting to give the names and numbers in the Herd-Books of the principal sires brought into the herd, with short notes as to their showyard records.

Fairfax Royal (6987), bred by Mr Torr; winner of 1st prize at Highland Show in 1847 in a class of 22.

Hudson (9228), bred by Mr Linton of Sheriff Hutton; winner of 1st prize at the Royal English and the Great Yorkshire Shows in 1848.

Velvet Jacket (10,998), bred by Mr Unthank, Netherscales; winner of the 1st prize at Highland Show, 1850, and the 1st prize at the Royal Northern Show.

Matadore (11,800), bred by Mr Smith, West Rasen; winner of the 1st prize at the Great Yorkshire Show, and the Lincolnshire Agricultural Show, in 1851. His portrait is given in vol. x. of the 'Herd-Book.'

Plantagenet (11,906), bred by Colonel Townley, Townley Park; winner of the 1st prize at the Royal Northern Show in 1851.

Lord Cardigan (13,177), bred by Mr Unthank, Netherscales; winner of 1st prize at the Royal Northern Show in 1855.

The Baron (13,833), bred by Mr R. Chaloner, King's Fort, Ireland; winner of 1st prizes at the Royal Dublin Show in 1854 and 1855, and 1st prize at Royal Northern Show as a two-year-old in 1855, and also the 1st prize against bulls of any age. The Baron's portrait is given in vol. xi. of the 'Herd-Book.'

Master Butterfly 2d (14,918), bred by Colonel Townley, Townley Park.

Lord Raglan (13,244), bred by M. S. Stewart, Southwick; winner of the 2d prize at the Highland Show in 1857, the 1st prize at the Glasgow Agricultural Show, the Perthshire Society 1st prize, and the Citizens' £30 Challenge Cup, in 1858. In 1860 he won the 1st prize, the £50 Challenge Cup, and the Australian gold medal, at the Royal Northern Show.

Ivanhoe (14,735), bred by M. S. Stewart, Southwick; winner of the 1st prize at Hexham in 1857. In 1859 he won 1st prizes at the Northumberland, the Durham, and the Tyneside Shows.

Lord Garlies (14,819), bred by M. S. Stewart, Southwick; winner of 1st prize at the Royal Irish Show.

Malachite (18,313), bred by Mr J. Peel, Knowlmere; winner of the 1st prize at the Royal English, the Royal North Lancashire, the Manchester and Liverpool, and the Craven and Wetherby Shows, in 1859. Malachite's portrait is given in vol. xiv. of the 'Herd-Book.'

Lancaster Comet (11,663), bred by Mr Wilkinson, Lenton, Nottingham; bought when nine years old, and famous as being the sire of Champion of England (17,526).

Windsor Augustus (19,157), bred by Mr Carr, Stackhouse; winner of the 1st prizes at Darlington, Halifax, Keighley, Ashton, and Skipton in 1861; and in 1862 he won 1st prizes at York, Halifax, Warrington, Durham, and Lincoln, when he also carried the Cup.

Forth (17,856), bred by Sir William Stirling-Maxwell, Bart.; winner in 1862 of the 1st prize at the Royal English Show at Battersea, 1st at Alloa, 1st at Perth and Citizens' Challenge Cup. In 1863, 1st prize at Highland Show and medal at Stirling. In 1864 he won 1st at the Royal English, 1st at Royal Northern, and Highland Society's silver medal at Aberdeen, the £50 Challenge Cup, and the Highland Society's gold medal at Stirling.

Lord Privy Seal (16,444), bred by the Prince Consort, Windsor; winner of the 1st prize at the Highland Show in 1859.

Scotch Rose (25,099), bred by the Duke of Montrose, and winner of fifteen prizes and challenge cups, two of them being of the value of 100 guineas each.

Baron Killerby (23,364), bred by Mr Pawlett, Beeston; winner of the 3d prize at the Royal English Show in 1870.

Prince Alfred (27,107), bred by Mr Pawlett, Beeston.

The above list is more or less a complete one of the bulls taken into the Sittyton herd, and from whatever point we look at it, it is a striking one. Never in the history of shorthorns have such an array of showyard sires been brought into any one herd; and when we consider that they were selected by one who has proved himself a master in his profession, we can to some extent realise the influence they were bound to exercise. One cannot over-estimate the influence such sires had on the general stock of shorthorns in the north of Scotland, as every existing herd drew more or less of its life's blood from Sittyton. Space would fail were an attempt made to enlarge on this point, but to do so would be needless. Any one with the slightest knowledge of the subject is aware of the fact that almost every North Country herd has been built up with Sittyton as its corner-stones.

While all those famous sires above mentioned were being used at Sittyton, there were always a few home-bred bulls in service; but a time came (about 1872) when nothing but home-bred ones were needed. For years Mr Cruickshank was anxious to get Lancaster Comet, and it was only, as we have seen, when the bull was nine years old that Mr Wilkinson could be prevailed upon to part with him. The change of climate and food was too much for the old bull, and he did little service. He left, however, a bull named Champion of England (17,526), whose influence in the herd, and indeed in

shorthorns as a breed, cannot be over-estimated. Mr Cruickshank, evidently satisfied that in this bull he was possessed of what he had long been aiming at, continued to use him for ten or twelve years, until directly and indirectly, through his sons, grandsons, and great-grandsons, &c., the whole herd, and in fact almost the whole of the North Country shorthorns, may be said to be full of his blood. One cannot fail to admire the greatness of the breeder, who in a steadfast way kept breeding his own ideal of what constituted the animal needed by the rent-paying farmers, when we consider that this was done for a long series of years, when fashion was dead against him, and when even owners of herds in his neighbourhood, who had up till then been satisfied with Sittyton sires to head their herds, turned against him. Many of them became infected with the general, we might justly say the universal, opinion that one of two sorts—Booth or Bates—ought to be at the head of every herd. We again repeat, when he kept steadily on while hundreds and thousands were freely given for single animals, and the whole shorthorn world was against him, the greatness and worth of the man stand out in bold relief.

His cattle were sneered at by men who were then called famous breeders. They were spoken of as good useful sorts of *a kind*, but a kind inferior in every respect to herds of mushroom growth. Even to-day we find men looked upon by many as authorities on all matters connected with shorthorn breeding, who know absolutely nothing of the Sittyton pedigrees.. These pedigrees are daily attracting more attention, and the more they are examined the more it becomes evident that the herd was bred on steadfast, careful lines.

The utmost limit of perfection in shorthorn breeding was not reached in the days of the Collings, as many would have us believe; nor are we prepared to assert that Amos Cruickshank has reached that limit. The purposes to be answered by the cattle of to-day are altogether different from what they were fifty or even twenty years ago, and there is still scope and room for brains and ability in the pursuit of shorthorn breeding. This aspect of the subject must not, however, be entered upon. It is a wide one, and one that forces itself forward more and more every day, as is evidenced by the fact that several of what we may term the newer breeds keep spreading and gaining popular favour.

While high prices were common for certain families and strains of blood, there was a strong current of opinion amongst breeders that they were bound to keep by certain lines, were expected to breed a certain class of animal—the inference being that the general public ought to acknowledge they were right.

This the public did for a time, and Scotch shorthorns were not only neglected but looked down upon and discounted.

Cruickshank Cattle in England.

When the reaction set in, and breeders began to look for fresh blood, attention was at once turned to the north. The success which attended the introduction of Cruickshank sires into herds full of Bates and Booth blood naturally led to many being taken south, and their general-utility qualifications widely acknowledged.

Owing to the great Canadian and American demand for Cruickshank cattle, which for some fifteen or sixteen years previous to the disposal of the Sittyton herd (in 1889) absorbed every available bull, there were comparatively few bulls bred by Mr Cruickshank in the country. The few that were belonged to breeders who knew their worth and meant to keep them. Under these circumstances the selection of sires to be taken south was restricted almost entirely to the last crop of bull-calves bred at Sittyton. Quite a number of these found their way into Southern herds, and the advantage of the fresh blood has evidently been fully recognised.

It is here fully acknowledged that there is much about the Scotch shorthorns which is certain to impress many breeders as being "common." They have neither the dash of the Bates cattle nor the round ribs of the Booth sort, while, generally speaking, they lack a certain finish of quarters which would tend to increase the apparent length of body. Many also object to the style of heads met with in the majority of Cruickshank bulls.

Judging from what Mr Cruickshank has done in bringing out a fixed type of animals, it is quite evident that his aim had been to produce a class of stock full of lean flesh and constitution, while other features, perhaps more showy and striking, seem to us to have been neglected. To infuse a little more of those striking features, and yet retain the main practical utility of these North Country cattle, is the ambition of several able men who have profited so largely through Mr Cruickshank's work. They have, without doubt, the hearty good wishes of all lovers of shorthorns.

Were we to begin to speak of the many herds of shorthorns that come under the title of "Scotch," we would exceed the limits of this paper. There are numerous herds spread over the north-east and north of Scotland that would have to be spoken of, and each would deserve careful and lengthy examination. Such, however, is quite beyond our purpose. We can only stop

to congratulate the owners of these herds upon the local and national good work in which they doubtless find pleasure, and, we trust, profit. By the production of good thick-fleshed young bulls they are encouraging their neighbours to breed a class of cattle better than any they can purchase in the store-sales or markets.

The production of a good class of young bulls leads to a demand for them, and the nation is so much the richer by every bull bred with care and practical judgment.

While it is impossible to speak of all the herds of Scotch cattle, mention must be made of those that more directly belong to the great parent of all, the Sittyton herd.

Before speaking of those herds in Scotland where pure Sittyton cattle are to be found, it may be well to notice several herds in England where cattle of straight Cruickshank blood are bred. And first must be mentioned the Royal herd at Windsor, where not a few of Mr Cruickshank's cattle have for years been bred. There are some nineteen females either direct from Sittyton or through the Messrs Nelson, who in 1889 purchased the entire herd.

This purchase was made with the intention of exporting to South America the entire herd, with the exception of some eighteen very old cows. Only thirty head were shipped, when the financial condition of the Republic made it unwise to send out such valuable cattle. Shorthorn breeders have cause to be thankful that such was the case, as it would have been little short of a national calamity had the original intention been carried out. As it was, the thirty that went are badly missed, as a large proportion of them were of the Pure Gold or Brawith Bud sort, one of the best families in the herd.

To return, however, to the Royal herd. While there are some beautiful females of the Cruickshank blood to be found at Windsor, it has been more directly the sires of this blood that have done so much to make the Scotch cattle famous at Windsor.

Only a sound and thoroughly practical judge, as Mr Tait has proved himself to be, could have taken the bold step he did in hiring Field-Marshal, the first Sittyton bull taken to Windsor. The boldness of the step can never be appreciated by the general public, and the thorough success which attended the bull's use gave critics no room to cavil at the change he made. The selection of this strain of blood to cross with the Windsor cattle was one of the many proofs Mr Tait, the manager of the Royal farms at Windsor, has given of his sound judgment.

There are two Sittyton sires at present at the head of the Royal herd. One is the Yorkshire 1st prize bull Gael (60,855), from one of the very oldest families Mr Cruickshank had, and the other, and more highly esteemed, is Volunteer (63,501), a

member of the Violet family, springing from one of the Lincolnshire females taken to Sittyton in 1840.

By far the largest holder of Sittyton cattle in England is Mr J. Deane Willis of Bapton Manor, Wilts. In the spring of 1890 Mr Willis visited the north and bought a number of females at the Towie Barclay sale, having before then used, with great success, several Scotch-bred bulls. While in the north, Mr Willis visited Sittyton, where the herd, then in the possession of Messrs Nelson, was still located. He was very much impressed with the lot of yearling heifers, thirty-three in all. Negotiations were entered into which ended in the whole lot being bought and transferred to Wiltshire.

The price paid was a high one; but when we consider that through the purchase Mr Willis became possessed of thirty-three young heifers, the result of more than fifty years' careful thought and work of one of the greatest breeders of shorthorns, we can safely assert that the purchase was a judicious one. Were proof needed, we might point to the fact that last autumn a *bonâ fide* offer representing the original outlay was made for ten of the lot.

Along with those females, Mr Willis has at present in the herd two bulls bred at Sittyton. They are Roan Robin (57,992) and Captain of the Guard (58,596), and they are backed up by Count Lavender (60,545) of great showyard fame, who is almost of pure Sittyton blood, and Christmas Present (63,793), a "straight"-bred Cruickshank bull.

In the west of England are to be found a few Sittyton females, in the hands of Mr T. T. Baker, Hawford Hill, Worcester, who has been using Sittyton sires with great success.

When the cattle were in the possession of the Messrs Nelson, an entire family, the Violets, was sold to Mr R. N. Sutton Nelthorpe of Scawley, Lincolnshire. The most of this lot have, however, been lately taken north again by Mr William Duthie, of whom we shall have more to say.

With two females owned by Messrs Nelson and Bruce at Wylam-on-Tyne, one in Sir John Swinburne's herd at Capheaton, Northumberland, and one in the hands of Mr H. Theodore Cookson, Sturford Mead, Warminster, who has had two pure Cruickshank bulls in use, we pretty well exhaust the list of Sittyton females in England. It may strike breeders as peculiar that this strain of blood should be in so few hands even in England; but it must be borne in mind that for some sixteen years before the herd was finally sold, every female that could be spared from Sittyton, and all the young bulls except those kept for a few regular customers, were contracted for, first by a Canadian and afterwards by an American speculator.

We now grieve to think that such animals should have been

allowed year after year to leave our shores. The fact that they did so accounts for the unparalleled success of Scotch cattle at the great World's Fair at Chicago in 1893.

Cruickshank Cattle in Scotland.

There are, we believe, only three herds in Scotland where direct Sittyton females are to be found. In two—those of Mr Wilson, Castle Park, Huntly, and Mr Cameron, Fettes, —the numbers are small, but the selection of the animals has been made with great care and judgment. With regard to the other—that of Mr Duthie, Colbynie, Tarves—volumes might be written. At the time the entire Sittyton herd was sold, Mr Duthie arranged to purchase from the Messrs Nelson all the cows over nine years of age, and in this lot he got possession of eighteen of the proved matrons of the herd. Had a public sale been made, we are inclined to think that a goodly number of these old cows would have been competed for more keenly than even the younger ones. With the annual draft made for so many years to go across the Atlantic, such old cows as were the best breeders were naturally retained in the herd, and but for a question as to their extreme age, they were the *crême de la crême* of the herd.

Along with a few disappointments, Mr Duthie has, on the whole, had good fortune. Quite a number of these matrons have gone on breeding in their new home, and several, at the date of writing, are in an interesting condition although nearly twenty years of age. When it was finally resolved to give up the idea of further shipping to South America, the Messrs Nelson gave Mr Duthie the offer of the females then left. This lot he also bought, so that he became possessed of about forty of the Sittyton females.

These were taken into a herd where several pure Cruickshank females, bought at different times, and a large number of cattle of practically Sittyton blood, made up a lot second only in merit to the Sittyton herd.

For a great number of years Mr Duthie had a preference in the selection of sires from Sittyton, and although the prices are understood to have been high, a bull was selected and bought almost every year.

Knowing the Sittyton herd so intimately, and having enjoyed the close friendship of "the grand old man" at the head of it, Mr Duthie had advantages beyond any one else. These he had the wisdom to appreciate and utilise properly, and he now owns one of the largest, and without doubt one of the very best, herds in the world. For several years he has disposed of the majority of his bull-calves when they are weaned in the

autumn, and the prices realised indicate the public estimate of their value. When we say the majority of his bull-calves, it must not be understood that inferior ones are kept back so that the average price may be kept up. We know that year by year a few of the best are kept for home purposes, and all the others sold without reserve. Over £50 of an average was made last autumn for twenty-one calves, the oldest being twelve and the youngest six months old.

Although it is quite impossible, as indicated above, that attention could here be given to the many valuable herds of shorthorn cattle in the north, it seems to us that any paper on this subject would be incomplete without at least a reference to the herd at Uppermill, so long and carefully bred by Mr W. S. Marr. Large in size, and composed of a beautiful lot of cattle full of Sittyton blood, this herd sends out a large number of bulls annually, to the benefit of the country. Many of the smaller herds owe their existence to the Uppermill herd, while several of the great showyard animals in the United States were bred by Mr Marr.

The herd belonging to Lord Lovat must also be mentioned, as the principal families in the herd spring from the Sittyton Broadhooks. The management of the herd is in the hands of Mr R. Lawson, one of the best judges and most capable managers in the kingdom. If the herd had done nothing else than produce New Year's Gift (57,796)—bought at the Windsor sale in 1891 by the Earl of Faversham for 1000 guineas—it would have earned a lasting name; but for many years past the young bulls from Lord Lovat's herd have commanded high prices at the Inverness and Perth annual sales, and several herds that are now doing good work in the northern counties were started with females bred at Beaufort.

With a word as to a small but very select herd owned by Mr A. M. Gordon of Newton, Insch, Aberdeenshire, this part of the subject must be dismissed. Mr Gordon's herd is singled out from the many that might be spoken of on account of its composition. Amongst several good families at Newton is one, the Clipper, noted as being selected from the many good sorts at Sittyton as a family for breeding stock-bulls in the latter days of the herd.

General Management at Sittyton.

Taking Sittyton as the parent herd of the Scotch shorthorns of the present day, and having in a general way indicated how the herd was built up and maintained, it may be well to speak shortly on the general management at Sittyton. In doing so, the system of feeding and management generally pursued in the north will be clearly indicated, as all more or less pursue the same system.

The severe climate and the absence of old grass-pastures in the north necessitate house-feeding almost entirely from October to May. In other words, taking one year with another, eight months out of the twelve are spent by all the stock in the byres and boxes. As a rule, the whole of the females are tied by the neck and stand two together in a stall, the different byres being arranged with wider and narrower stalls to suit the several ages of the cattle. To South Country visitors a string of newly weaned heifer-calves tied by the necks is a novel sight, and the question naturally occurs, Would not these young animals thrive and develop better if wintered in comfortable yards? No doubt they would, but the large proportion of grain crops being oats, the straw is too valuable to be spread as litter in yards or even in boxes.

It has been found that cattle can be kept more comfortable and clean on a small quantity of straw as litter, tied by the neck than when left loose, let the construction of the yards or boxes be as it may. Under a five- or six-course rotation of cropping, with either two or three grasses, there is on all farms a fifth or sixth of the entire acreage year by year under turnips. These consist of from one-third to one-half swedes and the balance yellows. On most of the farms, when the stocks are altogether breeding animals, a larger proportion of yellow turnips are grown, as they are considered to be equally good for cows and growing cattle, while they can be grown at less cost.

The months of December, January, February, and March constitute the favourite calving season, but in all large herds calves are dropped at other seasons of the year.

The breeding cows are tied up one year with another about the middle of October, and almost invariably remain so tied till they go to grass about the middle of May. They are fed up to calving-time on yellow turnips and oat-straw, the weight of turnips given being of sufficient quantity to keep the animal's bowels in a proper condition. Few, if any, of the cows get cake or meal, although in the case of breeding from heifers at about twenty-four to twenty-six or -eight months old, cake is sometimes used to strengthen the animals and assist them to rear their calves.

At Sittyton the cows were arranged in byres so that the earlier calvers were together; and the calves when dropped, after being tied for a few days, were allowed to run loose in the byre, care being taken that none acquired the habit of stealing its neighbour's milk. Calves born in December or the earlier months of the year, long before grass-time, naturally needed more than milk, and turnips cut small and other tit-bits were provided for them; but, as a rule, those consisted of fodder grown upon the farm.

For many years Mr Cruickshank bred from heifers served when they were from fourteen to sixteen months old. His experience is that a larger percentage of them became breeders than if they had been left till the following year before being served. His statement is: "I adopted the plan of having the heifers served when about fourteen or sixteen months old, and never found any objection to it; late calves, calved after May, I generally left a year longer."

When the calving season set in, with the whole of the calves raised by suckling, it was a matter of great importance that each calf should be properly nursed. Careful attention was given to this, and changing of bull-calves from heifers to older cows, giving them heifer-calves in their stead, was freely resorted to. Although the calves were allowed to take all the milk they required, the cows were carefully attended to and milked dry at regular intervals.

A winter visitor at Sittyton would have found the cows and most of the two-year-old heifers in the byres either with calves at foot or in calf. The few late two-year-old heifers and the yearling heifers were tied up in byres, their food throughout the winter being turnips and oat-straw, while the bulls of all ages would have been found in loose boxes. The stock-bulls were kept in boxes, having a corner bedded down, and the rest of the floor paved with cobble-stones, and kept clean and hard. The young bulls, calves of the previous season, were, as a rule, kept two together in a string of hovels, with small open yards facing the sun in front of them. Every attention was given to have the young bulls forward in condition, so as to make them strong and fit for service at an early age. This was the more difficult on account of the infirmity known in the north as rheumatism, and in Yorkshire as "cripple-fellon," which is the great bane of bull-breeding in many parts of the country.

Breeders of bulls have got little assistance from the veterinary faculty as to the nature or prevention of this ailment; but experience has taught them that much nitrogenous food is dangerous, and much as a breeder would wish to see his young bulls become big and fit, he has to restrict food and otherwise exercise great care, so as to keep them sound on their legs. This mischief, be it what it may, is seldom seen in heifers after they are nine months old, and hence it is quite safe to treat up the heifer-calves when they are weaned, when such a course would result in the bulls becoming confirmed cripples. Nor is it because bulls are fed more highly than heifers that they are more liable to suffer. If treated alike, the bulls would succumb while the heifers would escape.

The Sittyton bulls were fed moderately well, a corner in each hovel was kept littered, while the floor otherwise was bare, and

swept clean at least twice a-day. Every precaution was taken to avert losses through rheumatism; but, generally speaking, a few suffered after every care was taken.

Very little artificial food was used at Sittyton, Mr Cruickshank's aim being to make the produce of the farm sustain the herd. A little linseed-cake was given to some of the smaller of the heifers when they became mothers, the other female animals having to depend entirely upon turnips and oat-straw during the whole of the winter and spring months.

When put on the pastures, as the whole female stock was in the end of May, the fresh young grass had a wonderful effect on the heifers, cows, and calves. To many South Country breeders the whole of the first year's grass being eaten by cattle is quite a departure from all grazing customs, but the Aberdeenshire breeders follow this system with great success. No doubt the nature of the soil allows this to be done; and the land being full of phosphates, applied in large quantities every fifth or sixth year to ensure turnip crops, accounts, doubtless, for the extraordinary feeding properties in the grass.

The different fields were visited twice a-day by the cattle-man, who took this opportunity of walking out the stock-bulls, leading one round as he inspected the different lots of cattle.

We know it is a rather commonly held opinion that stock from old cows and bulls, more especially the former, are not so strong or good as from younger parents. This idea is not endorsed by Mr Cruickshank, who writes: "I never saw any tendency in either cows or bulls to deteriorate as breeders with old age. Many of my best cattle were the produce of old cows and old bulls. If a bull turned out well, I generally kept him as long as he would live and be useful."

Breeding as Mr Cruickshank did for many years entirely within his own stock, the older cows, many of them twelve to sixteen and eighteen years of age, were almost invaluable, allowing, as they did, a reasonable amount of close breeding without his having to resort to in-and-in breeding. It was only in a herd where strength of constitution had been maintained, and where the milking qualifications of the females had been attended to, that such matrons could have been found.

The loss of milk in many herds is a direct one; but the mischief does not end with this. Our general experience is, wherever we find nurse-cows needed to supply the calf stock with milk, we may look in vain for old breeding cows.

Independently of the direct results of Mr Cruickshank's doings as a breeder of shorthorns, there is in his lifetime's work much that must have a far-reaching effect.

Had he taken to either of the two fashionable strains of blood about the time he began to use bulls of his own breeding, there

can be little doubt he would have bred a superior class of cattle. Acknowledging this, it must also be said that the influence of his work for the general good would have been much less pronounced.

Through the independent stand that he took, through his ability and judgment, he has shown to owners of all kinds and breeds of cattle that there is no finality in the pursuit of cattle-breeding. He has shattered prejudices, he has given breadth to all matters connected with the breeding of pedigree stock beyond what seemed possible a few years ago, and he has educated the general public to recognise ability and genius, which were apparently looked upon as lost in the profession.

By doing so, he has smoothed the way for those engaged in cattle-breeding, seeing his success can be quoted by all who see fit to take an independent course.

In conclusion, let it be remembered that the ascendency of Scotch shorthorns is but a natural, as it is a healthy, sign of the times. Since the palmy days of the earlier seventies, there has been quite a revolution in British agriculture. One wave of depression has followed another, leaving the landed proprietors and tenant-farmers of this country poorer by untold sums of money.

It is the nature of things that in times of financial adversity fashion goes to the wall and practical utility comes to the front. Fancy in shorthorn breeding had its day, practical utility is now the main object sought for. Hence the ascendency of the Scotch shorthorns of the present day.

POTATO-GROWING IN THE LOTHIANS.

By Charles J. B. Macdonald, Editor of the 'Farmer and Stock-Breeder.'

The three famous East of Scotland counties which constitute the Lothians have acquired an agricultural reputation far beyond what would have been attained through the agency of speciality in the production of any one crop. The excellence of Lothian farming in all its branches is well known, not only in Britain, but also in many other parts of the world. But while that is an admitted fact, it is perhaps in the production of potatoes more than in any other direction that the Lothians most signally excel.

In the matter of arable farming the Lothians are more versatile than almost any other part of Great Britain. This remark

is true of the capability of the land rather than of the methods that are found to obtain in practice. The crops grown in these counties differ little from those cultivated in many other parts of the country as far as variety is concerned. But in the all-round excellence of the year's produce it will, I believe, be found that no other three adjacent counties in the kingdom can seriously rival the Lothians. Most of the land in the low-lying arable parts is capable of yielding produce of the finest quality of almost any farm crop. Perhaps it would be more strictly accurate to describe the Lothians as surpassing in the wonderful manner in which all common farm crops grow and mature thereon, than for the unusual partiality of one crop, save the "tuber," and that chiefly in merit. It is in regard to potato-culture that the Lothians are fairly and justly entitled to the distinction of unparalleled eminence.

The Lothian-grown potatoes are familiar in all the leading British markets. In the great London markets they are particularly popular, and seldom lack plenty of purchasers, even when wholesome-looking potatoes from other parts are not convertible at any price.

Although the Lothians proper comprise the counties of Edinburgh, Haddington, and Linlithgow, the potato-growing Lothians may be said to consist only of Haddington and the greater portion of the metropolitan county. The western district of Mid-Lothian and West Lothian possess no special claims to fame in the production of potatoes, although of course the crop is grown to a certain extent, and with more than average success. The district of potato fame stretches, roughly speaking, along the coast from Queensferry to Dunbar, and extending inland to varying distances in Mid-Lothian, but generally to near the border of East Lothian.

The Soil and Quality in Potatoes.

The high reputation of the Lothian-grown potatoes is mainly attributable to the suitable nature of the soil of the district. As is generally known, the potato is in some respects very partial to certain kinds of land and equally hateful of others. The crop in average years will usually thrive ordinarily well on any variety of land, except on stiff tenacious clays or on badly drained, water-logged soils of any sort. Careful cultivation and liberal manurial treatment may frequently produce a heavy crop of tubers on very ordinary land in any part of the country. Indeed, as regards yield per acre, the Lothians by no means excel all other parts. On an average, perhaps they are not surpassed in that respect; but we frequently hear of the Lothian yields being exceeded both in England and in other parts of

Scotland. In point of quality, however, the Lothian tubers hold a clear lead of those produced in any other part of this country. It is in this direction that the special character of the land is evidenced, or, in other words, in which the plant shows its marked partiality in choice of soils.

The peculiar merit of Dunbar potatoes is unquestionably due to the special quality of the soil in that neighbourhood. Most of the land in that locality is of a light thin friable nature, and mostly naturally dry. In fact, much of it presents an appearance betokening little value for any agricultural purpose, the stony sapless surface reminding one more forcibly of a gravel bank than of successful crop-growing land. The small quantity of soil there is, however, is of the most active and kindly description, and by a well-judged system of management is farmed to great advantage.

A prominent farmer in the neighbourhood of Dunbar supplies the following interesting account of that famous potato-growing district. He says: "The favoured red-soil district of Dunbar is about ten miles long and from one to two miles wide, and the potatoes grown there are of very fine quality, commanding the highest prices in the London market. They make 2s. per boll, or 10s. per ton, more than those grown on the grey soils. They keep till the following May or June; but that peculiar quality is of no use now, as early kinds come from Malta, Canary Islands, &c., long before that time, so prices never rise now at the end of the season for old potatoes as they used to always do some years ago. Another peculiarity the red-soil potatoes have is this, that if sent up to lunch and not all used the remainder can be heated up at any time and come to the table quite white, whereas other kinds would be yellow. Eighteen to twenty years ago £10 to £14 per ton used to be got for old potatoes in May or June."

The Climate.

The climate of the Lothians is favourable in certain respects, but in others it is nothing to boast of. The cold east winds, which sweep round the unprotected coast with great force, often cause considerable damage to growing crops, and have a tendency to retard growth at critical stages of the crop's history.

Management.

The well-deserved agricultural fame which the Lothians enjoy is not altogether due to the natural conditions under which farming is pursued. In reading of the reputation of a district one is sometimes inclined to place the chief share of

the honour to the credit of the soil and climate, and apt to overlook the no less important part the farmers play in the attainment of the result. It is not too much to say that the Lothians never would have attained their wide reputation had they not contained within their bounds some of the best-managed farms that are to be found in any country. Very appropriately the class of farmers that have been for many years and are now in possession of the majority of Lothian farms are of the highest and most intelligent order. They may be briefly described as selected men. Generally, landowners have been exceptionally careful in letting these holdings, with the happy result that, as a rule, only well-trained, thoroughly practical tenants have been chosen. That the enviable name the Lothians hold is due to the happy combination of good land and pre-eminently good management, there can be no doubt whatever. This will be obvious even to the casual passer-by—quite as obvious as the few instances of bad farming which, let it be supposed, exist just to prove the rule already indicated.

The Potato Crop.

The cultivation of the potato crop naturally forms an unusually important branch of farming in the Lothians. This crop frequently occupies from an eighth to a fourth of the farm, and in some exceptional cases as much as a third will be under potatoes.

Such an intensive system of cropping necessarily renders farming a very laborious and risky business. The potato is an exceedingly costly crop to produce. It is not so particular about the amount of cultivation the land receives before it is planted as most farm crops are. In fact it is singularly indifferent in that respect, although what tillage is necessary must be done seasonably. But the land must be in good heart and thoroughly clean, and, as a rule, a pretty substantial outlay is contracted before these essential conditions are obtained.

The lifting of potatoes is also a very costly process, and while the crop is brought to maturity at an unusually heavy cost, its value is a matter of great uncertainty. It is so for two main reasons. The crop may be at fault either through failure of growth or destruction by disease; or the market price may, on account of an overstocked market, which frequently happens, be so low as to be altogether inadequate to repay the grower for his labour and other outlays.

The returns from the potato crop, therefore, fluctuate to an extraordinary extent. But in spite of this fact, the attention and devotion to potato-growing do not appear to in any way diminish. In the Lothians the potato area varies perhaps less

than it does in any other county which can claim to be a potato-growing district.

In view of the wonderful success which East and Mid Lothians have attained in the production of potatoes, it may be interesting, and I hope instructive as well, to present as briefly as possible particulars of the methods of management pursued on the leading farms in these counties.

Rotation.

The place the potato crop usually occupies in the rotation is after a grain crop. Where oats are grown in regular rotation, the potatoes generally follow that crop and precede wheat. A very good and fairly representative Lothian rotation—is potatoes, wheat, turnips, barley, grass and clover, oats. Sometimes potatoes are planted after grass, which custom appears to give very good results. In other cases, where no restrictions as to cropping exist, the order varies somewhat, especially where potatoes occupy more than a rotation proportion of the farm.

On the famous farm of East Barns, for example, where Mr James Hope pursues a six-course rotation, the order observed is—grass, potatoes, turnips, barley or wheat, potatoes, wheat or barley. It will be noticed that potatoes come in twice in the rotation. On this farm a third of the arable land is annually under potatoes.

On several farms where the four-course rotation obtains, potatoes are repeated only every eight years. The crop shares the fourth "shift" with turnips, and for the benefit of the latter the potatoes occupy the portions of the break alternately with the roots. The general custom, however, is to repeat the crop every sixth year. The area under potatoes on farms of 300 or 400 acres often extends to 50 or 70 acres, while on Mr Hope's farm, already referred to, no fewer than 340 acres are grown annually.

Autumn Cultivation.

The importance of accomplishing as much as possible of the tillage work in autumn is continuing to force itself upon farmers. The spring months are usually found short enough for the operations that cannot be overtaken at any other season. It is therefore very desirable that as much of the preparatory tillage work as possible should be performed before winter sets in.

The Lothian farmers make good use of the autumn months. The prevailing custom is to spread the farmyard or other long manure on the stubbles or grass, and to plough it down in autumn or during winter, as the weather will permit. The

autumn furrow is generally a deep one. Where the land will allow, it is usually ploughed in autumn to a depth of 8 or 9 or even 10 inches. For autumn work some use the ordinary Scotch swing-plough, and others prefer the American chilled plough. On a few farms the operation known as subsoiling is occasionally resorted to. For this work the ordinary swing-plough, minus the mould-board, is used. It follows the American plough, and stirs or raises the subsoil to the depth of 6 or 7 inches.

Subsoiling is to be recommended for several reasons. It is chiefly advantageous in that it loosens the land to a great depth without bringing the unproductive subsoil to the surface, thus securing the advantages of deep cultivation without any of its evil influences.

Spring Cultivation.

As is to be expected, the spring treatment of the potato-land varies to a considerable extent. The varying nature and condition of the soils necessitate altered systems of management. On some prominent farms the spring cultivation prior to drilling consists of the simple operation of a double strip of the ordinary harrows. This is the case only when the soil has been well pulverised by the winter frosts, and when there is an entire or almost entire absence of weeds.

As much of the soil in the Lothians is of a free open nature, heavy spring cultivation is seldom necessary to bring the land into a fit state for the drill-plough. The intensive system of farming, on the other hand, proves almost fatal to the growth of weeds, so that only on rare occasions is extra labour entailed for cleaning purposes. These circumstances, added to the simple demands of the potato crop in the matter of tilth, render an elaborate course of preparation quite unnecessary.

Although the light treatment referred to is found sufficient in several cases, perhaps the more general system includes the use of the grubber or cultivator, and the roller or clod-crusher.

Spring ploughing is seldom practised. When potatoes follow grass, some cross-plough the land in spring, but under no other conditions have I found this operation resorted to.

Mr James Hope says he sometimes has to use the grubber and harrows, and sometimes the latter only, with a turn of a roller if the surface is in any way rough. He is in the fortunate position, however, of having no cleaning to do.

Mr W. M. Welsh, Liberton Mains, has his potato-land thoroughly worked with a heavy three-horse cultivator, then double-harrowed, afterwards rolled with a heavy roller, and drilled.

The method pursued by Mr George Dods, Hedderwick,

Dunbar, is to double-harrow, grub with a heavy two-horse grubber, harrow again, and roll if the land is at all rough.

Mr John Dobbie, Campend, Dalkeith, gives similar treatment, except that in the case of a rough surface he uses a clod-crusher.

Mr R. B. Macdonald, Granton Mains, whose soil is not of the finest quality for the crop, being a heavy loam resting on a stiff clay subsoil, also follows a somewhat similar course, but is more exacting in some details. In his case "the winter or autumn furrow is harrowed across, rolled, grubbed to the depth of the furrow, harrowed, rolled, and again harrowed; it may or may not receive a third rolling before being drilled." He adds: "Care is taken that a greater breadth than 30 to 36 yards is not operated on at one time; or, in other words, that the first harrowing does not take up ground more than 30 or 36 yards from where the drill-plough is working." If the land is dirty, the weeds are gathered between the operations.

For opening and closing the drills the ordinary double mould-board plough is generally used. The only instance that has come under my notice where the common drill-plough is not in favour is at Campend. Mr Dobbie always opens and closes the drills with the single mould-board plough, for the reason that he thinks it works the land better than the double-boarded plough.

Manures.

The most suitable manure for the potato crop is home-made farmyard dung. This manure appears to contain all the ingredients most essential to the prosperity of the crop. It is not surprising, therefore, that the potato-break receives a liberal quantity of farmyard dung. In a few cases this manure alone is used. Mr George Dods, for example, adheres firmly to the belief that a dressing of about 30 tons per acre, costing about £9, of manure made from horses and cattle—the latter being liberally fed with grains and cake—is in itself ample to produce a good crop.

In reference to this point Mr Dods writes: "I do not use artificials, as the variety of potatoes I plant grows large tops, and an addition of ammonia would tend to increase the evil. The variety is 'Maincrop.' They produce a less prolific crop than most other kinds, but the quality is superior, and consequently they realise the top price. They are also almost free from disease."

On the majority of farms, however, the 30 to 35 tons per acre of farmyard dung is supplemented by various mixtures of light artificial manures. These generally consist of superphosphate, guano, and bone-meal, but sulphate of ammonia,

kainit, slag, and nitrate of soda are also applied with good results.

Mr R. B. Macdonald, in addition to 30 tons dung, alternates 3 to 4 cwt. guano, 1 to 1½ cwt. sulphate of ammonia, and 2½ to 3½ cwt. superphosphate, and 3 to 4 cwt. fermented bones, which cost, exclusive of the dung, from 20s. to 30s. per acre.

Mr John Amour, Cramond Bridge, uses from 25 to 30 tons dung, and to this he adds 1½ cwt. guano, 2 cwt. kainit, and 4 cwt. superphosphate and slag phosphate mixed, and 1½ cwt. nitrate of soda, which, apart from the dung, costs from 45s. to 50s. per acre.

The Saughton Mains dressing is 3 cwt. vitriolated bone-meal and 1 cwt. sulphate of ammonia, in addition to 35 tons of farmyard manure per acre. The dung costs 7s. per ton, and the artificials 25s. to 30s. per acre.

On Liberton Mains the 30 tons cow manure or 40 tons "police" manure are supplemented by 1 cwt. Lawes' guano, and 5 cwt. Lawes' special dissolved bones, costing 39s. per acre.

Mr William Renwick, Meadowfield, applies a mixture consisting of ¾ cwt. sulphate of ammonia, 1 cwt. muriate of potash, and 3 cwt. of bone-meal, costing from 27s. 6d. to 30s. per acre, in addition to about 34 tons of dung.

Mr Gavin Jack, Swanston, gives 5 to 6 cwt. fermented bones per acre when the farmyard manure — 35 tons per acre — is ploughed down; but when the dung is put in the drills no artificials are used.

The dressing on a Portobello farm consists of 6 cwt. per acre of a mixture comprising two-thirds bones, one-sixth potash, and one-sixth ammonia, in addition to 30 tons of dung, which together cost about £9 per acre.

Bones, guano, potash, and superphosphate are the ingredients used on a Dunbar farm, and these are applied at the rate of 6 cwt. (£2) per acre with dung; without dung, from 10 to 12 cwt. per acre.

Mr Andrew Renwick, East Pilton, applies 35 to 40 tons horse and cow manure, costing 3s. per ton in Edinburgh, with a dressing of 4 to 5 cwt. per acre of a special artificial mixture costing £6 per ton.

On Kirklandhill, Mr James Clark uses 20 tons farmyard manure, 4 cwt. dissolved bones, 1 cwt. ammonia, and 1 cwt. potash per acre, at a cost of about £8, 10s.

Mr Andrew Smith, Longniddry, gives 5 to 6 cwt. of a mixture of bone-meal, potash, and sulphate of ammonia, costing 27s. 6d. to 33s., and 35 tons of good cake-made long dung, costing £9 per acre, when after stubbles; but after two years' lea he gives 10 to 12 cwt. per acre of the mixture referred to, costing 55s. to 66s., without any dung.

Mr James Hope's allowance is about 20 tons of dung at a cost of £6 per acre, a fair quantity of "spent hops" from the Edinburgh breweries, and 1½ cwt. per acre of nitrate of soda.

Mr John Dobbie uses only horse and cow dung, chiefly from Edinburgh, and "spent hops." The former he applies at the rate of about 35 tons per acre, which he reckons costs him from £12 to £13.

These examples I have quoted may be accepted as representing pretty accurately the methods of manuring practised generally in the Lothians.

Application of Manures.

The general rule with the farmyard manure is, as already indicated, to cart it out on to the stubble-land as soon after the crops have been cleared away as is convenient. On many farms very exacting rules as to its distribution are laid down. Mr Wm. Renwick's system, which is a common one, is to draw off the land with light furrows into 18-feet squares. To every one of these squares he allows 5 cwt. dung, which amounts to about 34 tons per imperial acre. This method possesses the recommendation of ensuring an equal division of the manure. Of course there is no special reason for fixing the dimensions of the squares at 18 feet. The size can be, and is, regulated as convenience may direct. It is necessary, however, to calculate the proportions both of the land and manure, so that an equal distribution of the allotted quantity may be obtained. A cart-load of manure is usually reckoned to weigh a ton, and this quantity should be made to cover a certain area, as is done in the case mentioned, where a ton is divided over four of the specified squares.

The manure is spread as soon as possible after it reaches the field. The Lothian farmers appear to be unanimous in enforcing this method, rightly maintaining that if the dung were allowed to remain any length of time in heaps an irregular crop would result, by means of the ground covered by the heaps receiving an undue, and probably an injurious, amount of nutritive substances.

Opinion is not so much at one as to whether the dung should be ploughed down in its fresh state—that is, immediately after being spread on the land—or whether it should be allowed to lie on the surface for some time. Some seem to attach little importance to the point, while others strongly emphasise the desirability of allowing the manure to lie exposed for a considerable time before it is ploughed under. From the evidence I have been able to collect, however, I have no doubt that there is a prevailing opinion in favour of a few weeks' surface ex-

posure to the dung; although tempting weather for ploughing often induces farmers to plough in the dung immediately.

Mr R. B. Macdonald prefers to let the dung lie "as long as possible exposed, say about a couple of months." Mr George Dods spreads the dung at once, but "the land is not ploughed for some time, to allow the rain to wash the essence into the soil." Mr Andrew Smith applies the dung in autumn, and spreads it immediately, but it is "allowed to lie until after the New Year before being ploughed in." On many other well-managed farms a considerable interval is allowed to elapse between the manuring and ploughing operations.

The only cases that have come under notice in which farm-yard manure is by preference applied in the drill in spring are when the production of early potatoes is the object in view. Several leading potato-growers believe in spring manuring for early maturing varieties of potatoes. But even in these cases only half the quantity is held over for spring application, the other half having been ploughed in in autumn or winter in the ordinary way.

In reference to this point, Mr R. B. Macdonald, who for early potatoes has hitherto applied the dung in two dressings as described, says, "I am now of opinion, however, that early potatoes should get all the long manure on the stubbles."

The "spent hops" is applied in autumn and ploughed down.

Light or artificial manures are all applied in the open drills along with the seed in spring, with the exception of nitrate of soda, which is sometimes applied at a later stage. Some sow broadcast over the open drills; but the majority sow *in* the drills only, and thereby place the fertilisers in closer proximity to the seed.

Nitrate of soda is not very extensively used for the potato crop. Most of those who include it in their list of dressings prefer to delay its application until just before the drills are finally earthed up. Mr James Hope, however, is a notable exception to those who adopt this plan. He applies about 1½ cwt. of nitrate of soda per acre in the drills with the seed, which may be taken as reliable evidence that no injury results from the early contact of the young plants with this quick-acting manure.

The great majority sow the artificial manure with the hand, but in a few instances broadcasting machines are employed. Some sow the manure before the seed is put in; others reverse this order.

As bearing on the value of nitrate of soda for the potato crop, it may be of interest to produce the following results in the potato-growing competition, held in 1893 under the auspices of the Dalkeith Agricultural Society, for the prize presented by

the Permanent Nitrate Committee, London, for the best acre of potatoes grown with that manure in addition to other fertilisers:—

	Good.			Small.			Diseased.			Total Crop.		
	tons	cwt.	qr.	tons	cwt.	qr.	tons	cwt.	qr.	tons	cwt.	qr.
1. A. Ainslie .	11	1	0	1	6	3	0	0	0	12	7	3
2. A. Howie .	10	7	0	1	12	1	0	7	0	12	6	1
3. A. Ainslie .	9	4	3	1	3	3	0	0	0	10	8	2
4. T. Hutchison	8	18	3	1	4	1	0	3	1	10	6	1
5. W. Gardner	7	2	1	0	18	0	0	7	3	8	8	0

Variety of Potato.	When planted.	Manures applied.
1. Bruce . .	April 25	20 tons dung, 4 cwt. kainit, and 4 cwt. supers in drill; $1\frac{1}{2}$ cwt. nitre when through; $1\frac{1}{2}$ cwt. when set up.
2. Regents .	April 2	24 tons dung, 5 cwt. dissolved bones; 1 cwt. nitre in drill.
3. Maincrop .	Same	As No. 1.
4. Lady Frances	April 6	10 tons dung, 2 cwt. dissolved bones, 2 cwt. supers, and $1\frac{1}{4}$ cwt. nitre in drill; 1 cwt. nitre when set up.
5. Sutton's Abundance	May 3	20 tons dung, 3 cwt. bone-meal, 3 cwt. supers, 1 cwt. sulphate of potash, and 1 cwt. nitre in drill; 1 cwt. nitre, 27th June.

PREVIOUS CROPPING.

No.	1889.	1890.	1891.	1892.
1	Pasture.	Pasture.	Pasture.	Oats.
2	Hay.	Pasture.	Pasture.	Oats.
3	Pasture.	Pasture.	Pasture.	Oats.
4	Barley.	Hay.	Oats.	Wheat.
5	Turnips.	Barley.	Hay.	Oats.

All the crops were grown on good medium loam.

Planting.

The time of planting naturally varies according to the varieties grown and the market aimed at meeting. If the object in view is to supply the early market, the early-maturing varieties have to be deposited in the drills as early in spring as the weather and condition of the land will permit.

The usual time for planting potatoes of this class is from the middle till the end of March, although some plant as early as the first of that month. The later and more extensively cultivated descriptions are planted, as the prevailing conditions may prescribe, any time from about the 20th of March till the end of April.

The one prevailing method of planting is in drills. The double mould-board plough is generally employed in opening and closing the drills; but, as previously noticed, the ordinary single plough is occasionally preferred for both operations, while others open the drills with the double and close them with the single plough.

There is considerable diversity both in the width of drills and in the distance between the "sets" or seeds. For the early varieties, the distances are usually less than for the later sorts. The common width of drills ranges from 27 to 29 inches, the early-planted being generally about the former, and for the later and stronger-growing kinds 28 and 29 inches are common measurements.

The distances between the seeds vary from 9 to 14 inches, which is a much greater range than would be expected. The early sorts are usually placed 9 to 11 inches apart, and the others from 10 to 12 inches. Mr James Hope differs in his regulation measurements from the general practice. He makes his drills only 26½ inches wide, but he plants the seeds the unusual distance of 14 inches apart.

Planting is usually the work of women or boys. Four or five women, if kept constantly supplied with seed, will keep a pair of ploughs—the one opening and the other closing—going regularly. It is considered desirable to have as short an interval as possible between the operations of opening and closing the drills.

Some farmers employ peculiar methods of their own conception, which appear to prove appreciably useful in the rearing of potato crops. One or two instances of this kind have come under my notice. Mr R. B. Macdonald, Granton Mains, and Mr W. Park, Brunstane, both adopt the use of a one-horse grubber or drill-harrow in breaking the plough-pan before the seed is planted. Mr Macdonald employs this means only in the case of stiff land with a hard or dry bottom, and when he does use it, it follows immediately behind the drill-plough that opens the drills.

Mr Park appears to adopt the method in all kinds of soils. His system further differs from that pursued on Granton Mains in that he sows the artificial manures before the grubbing process is proceeded with. But probably this order is observed in consequence of the fact that he applies the artificials by the aid

of a broadcast distributor. This plan of breaking the hard pan created by the plough is a very good one, and might be followed more generally with beneficial results.

Mr W. Renwick makes a point of opening shallow drills and covering with deep furrows—a method which also merits consideration.

The only case where I discovered the "boxing" system in practice in the Lothians was on Mr John Amour's farm at Cramond Bridge. Mr Amour plants a few acres annually about the first week in April with early sorts that had been previously sprouted in boxes placed in byres. The boxing system may be said to have its headquarters in Ayrshire, and does not much concern the district embraced by this paper, although probably it may be in vogue on a few other farms in the neighbourhood of Edinburgh.

Seed and Seeding.

As is the case with all crops, the selection and preparation of potato-seed have a very important bearing upon the prosperity of the crop. The utmost care must be exercised in the preparation of the tubers intended for planting, so that only such as are sound in every particular may be used for that purpose.

Opinion, I find, is still divided as to the comparative merits of whole and cut seed. Most of the Lothian farmers use both cut and uncut seed, which would seem to indicate that few have satisfied themselves of the merits of either method. To say that the one class of seed was as popular, either in theory or in practice, as the other, however, would hardly convey a fair representation of the experience and custom of the district. There is no doubt whatever that experience has shown the planting of whole tubers to be the better plan, and as an inevitable consequence that method is gradually gaining in favour and extending in practice.

The general custom of the district is to plant "seconds" whole; but when the stipulated riddle does not produce enough of that class to seed the entire break, larger-sized potatoes, cut into two or three sets as the size and stock of "eyes" may warrant, are utilised.

A few varieties, such as Maincrop, the Bruce, and Kidneys, are invariably planted whole by several growers, as they have been found to yield a much better return than when cut seed is used.

Although these methods represent the more common form of management, there are a good many growers who strictly adhere to the use of one class of seed only. On a few farms all the seed is cut, while on a few others nothing but whole tubers are used for seeding purposes.

Of those who adhere to the method of using whole seed, Mr George Dods is a prominent representative. The tubers he selects vary from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches, and of these he plants 15 cwt. to the imperial acre. Mr James Hope prefers to plant whole "seconds" of about the size specified by Mr Dods, and does so as far as he can. But he generally requires more seed than these measurements produce, and to make up the deficiency he utilises the large green or "sunburnt" potatoes, which he cuts.

As I have hinted, the use of whole seed is gaining in favour, and the more enthusiastic advocates of the system confidently maintain that the days of the old-fashioned method are numbered. As indicating the growing tendency in this direction, I may instance the case of Mr W. Renwick, who writes: "I used to cut all my seed, but I am now planting a good many 'seconds' whole." He adds, "I like the seed to go through a $1\frac{3}{4}$-inch riddle, and to keep on the top of a $1\frac{1}{4}$-inch riddle."

The quantity of seed per imperial acre varies from 12 to 16 cwt.—generally the former of cut seed, and 14 to 16 cwt. of whole.

Treatment after Planting.

The manner in which the land is treated from the time the seed is put in until the plants begin to cover the drills varies somewhat in detail on different farms. It even differs on one farm at times. The amount of work and tillage naturally depend upon the condition and requirements of the land.

The first operation after planting, on some farms, is to roll with drill-roller; others harrow first, while a few begin with the drill-grubber. Rolling is a sort of special treatment for stiff or lumpy land, and only in a few exceptional cases does it form part of the regular routine. Harrowing is generally the first process after planting, and that is done about three weeks or a month after the drills are closed. The drill-grubber, as a rule, follows the harrows, some using a two-horse and others a single-horse implement.

In many cases this is all that is done until the plants are long and strong enough to render hand-hoeing safe; but on several farms it is the custom to re-form the drills with the drill-plough, and harrow down again before the young sprouts shoot through the ground.

After the plants reach 5 or 6 inches in length, hand-hoeing, followed by further drill-grubbing, takes place. Soon afterwards the drills are again set up with the double mould-board plough, which operation is in turn followed by further hand or horse hoeing, as the state of the land may suggest. After this comes the final operation—the earthing up with the drill-plough.

Mr James Hope's method is to "roll the drills with a roller [which is 'round,' not 'fluted'], and then harrow them just before the plants come through the ground. When through we hoe them after being grubbed, and when ready set them up."

Mr George Dods leaves the drills untouched for about a month after planting, and then "they are harrowed down to near the seed. The drill-grubber is set agoing between the drills, and is kept at work continuously until the roots are observed running into the grubbed land. They are then balked up with the double mould-board plough." That completes spring work, except that "as soon as the potato-tops appear above ground they are hand-hoed and the weeds destroyed, and if time allows it is repeated a second time."

Mr W. M. Welsh begins by rolling them "when starting into growth, but before the shoots appear above ground a harrow is run over the drills, then a horse-grubber is run between the drills; after that they are hand-hoed, and when large enough are set up with a double mould-board plough. Later in the season they are horse-hoed, and afterwards again hand-hoed, and finally set up with the plough."

Mr R. B. Macdonald writes: "If the drills are rough and soil strong, a Cambridge drill-roller is put over them. They then get alternately applications of the round or saddle harrows and balking-plough to kill any annual weeds, finishing with the round harrows. Before hand-hoeing a double-horse grubber is applied; the hoeing is followed some time after by a single-horse grubber. Before being finally balked up a single-horse grubber is applied again, and finished off with balking or earthing plough."

Mr W. Park's potatoes "are generally harrowed with drill or chain harrows, grubbed, and set up with plough; then harrowed before they come through the ground, then grubbed, hand-hoed once—twice if required—grubbed again, and then set up with drill-plough."

Mr John Dobbie commences with the Cambridge roller, and then "harrows down drills, sets them up and again harrows down, grubs with two horses, hand-hoes, grubs with one horse, and sets up."

Mr Andrew Smith's method is to "drill, roll, harrow, and rib up and harrow again; grub before hand-hoeing, after that grub deeply with two-horse grubber, and then set them up with a double mould-board plough."

Lifting.

The time and manner of lifting the crop largely depend upon the geographical position of the farm and the varieties of

potatoes grown. On farms in close proximity to Edinburgh, where the main object is to supply the keen demand that exists for early potatoes, lifting often begins as early as the first week in July. The early potatoes are invariably dug with the graip, as the rank green shaws then abundant prohibit the use of plough or digger.

Mr John Amour, who, as I have stated, grows a limited quantity on the "boxing" system, usually begins to dig for the Edinburgh market in the first week of July. Last year he began on the 30th of June. Mr R. B. Macdonald and Mr Andrew Renwick generally commence digging and marketing about the middle of July; Mr W. Park about the end of that month, and Mr W. Renwick and Mr Davidson about the middle of August. Mr Gavin Jack differs from most of the other growers of early potatoes by, when possible, selling them in the ground, the lifting being done by the buyer.

The later varieties are lifted any time from the end of September till the middle of November, as the nature of the season may decide. The graip is seldom used to any great extent in raising the matured crops. The operation is generally performed by means of the digger or potato-plough. The latter, however, appears to be the more popular implement. In many cases the potato-plough consists of the ordinary single plough minus the mould-board, for which an open iron frame or prong is substituted. Specially designed ploughs are also occasionally used.

It is rather surprising that the specially constructed diggers should be so few at the headquarters of potato-culture. None of the various designs in the market appear to have won anything approaching general favour in the Lothians, although there evidently is a strong desire to possess such an implement. Doubtless there is a fine field and handsome compensation for the inventor of the ideal digger. One farmer, referring to the subject, says, "The digger is not used in this neighbourhood for fear of damaging the fine-quality potatoes;" and another ventures the remark that there is "great room for a *good* digger—the present kind will need improvement."

Mr George Dods departs somewhat from the ordinary method of lifting, his custom being as follows: "The crop is generally lifted about the middle of October on till the first week of November, and, in my case, by the plough, the shaws being first pulled and carted off and burned, so as to kill any disease or microbes that may be on or in them. After the potatoes thrown up by the plough have been gathered the land is harrowed and grubbed, so that the crop is all got out."

As showing the extent and importance of this crop at East Barns, the following extract from a note received from Mr Hope

will be read with interest. Writing in October 1893, Mr Hope says: "This year I began to lift my crop on the 27th September, and although I have 335 acres, I hope to be done on the 31st October. I keep four ploughs going, and lift about 14 acres per day with something like 110 people, and in all about 30 horses engaged."

Storing.

This very important part of the crop's treatment varies to a very limited extent in the manner in which it is performed. The one prevailing method is to store in pits sunk about 6 inches in the ground and from 3 to 6 feet wide, the length of course being regulated by the available space and other matters of convenience. It is almost needless to mention that great care is observed in selecting the driest possible site for the pits. It is also an essential point that the potatoes should be put in in a thoroughly dry and wholesome condition.

The first *thatch*, as a rule, consists of wheat-straw, which is laid on to a depth of 4, 5, or even 6 inches. This is covered with a thick coating of earth often as deep as 9 or 10 inches. Generally the full complement of earth is applied at two operations. The first covering of perhaps 2 or 4 inches is put on when the pits are formed, the final dressing being added about a month later, or just before severe frosts are prevalent.

Most of the leading farmers agree in leaving the tops or ridges of the pits unearthed for some time after the potatoes are pitted. A month or six weeks often elapse before the tops are properly closed over, which is usually done when the last coating of earth is laid on. The object in leaving the ridges open as long as possible is to secure proper ventilation and thereby prevent heating.

Mr W. M. Welsh cuts pits 6 inches deep and 4 feet wide, and "the potatoes are heaped up to a height of 3 feet, covered thickly with straw, and then with earth about 8 inches thick. A strip along the top of the pits is left uncovered for some weeks, to allow ventilation and prevent heating, and then that part also is covered with earth."

Mr George Dods sets his pits on the surface of the ground about 4½ or 5 feet wide. A thatching of straw, generally wheat, 4 or 5 inches thick, is laid on with 9 inches of earth over it. He also leaves "the tops of the pits unearthed about a month to allow any heat to escape, after which either earth or rough dung is put on the top or open part in sufficient quantity to keep out the frost." Mr James Hope stores them in pits 6 feet wide, covered with "plenty of straw and about 10 inches of earth."

Produce of Potatoes.

The yield of the crop fluctuates to an unusual extent. Perhaps there is no crop on the farm, barring turnips, that varies in its return to the degree noticeable in the potato. Right up to the time of lifting a considerable amount of uncertainty exists as to the actual produce of the crop. Appearances on the drill are often found to have been misleading when the net results come to be reckoned up.

In the Lothians, as elsewhere, this peculiar quality of uncertainty attends the crop. The yields are found on some farms to vary from 3, 4, and 5 tons to 13 tons per acre, according to the soil and season.

Most of the leading potato-growers fix the average yield of marketable potatoes at about 8 tons per imperial acre. In addition to this they generally calculate upon having about a ton of seed size, and probably about the same quantity or a little less of "cattle-food" size. Others, again, estimate their marketable average at about 6 tons per acre, with the usual additions of the smaller descriptions.

The early varieties are seldom found so prolific in their yields as the later maturing kinds. This result, however, may to a considerable extent be due to the common custom of raising the former before they have reached full maturity—a practice for which the tempting prices of the early market are mainly accountable. That this is the case is shown by the evidence of a farmer close to Edinburgh who grows pretty extensively for the fancy prices of July. He gives his average yield at "3 to 4 tons at first, increasing to 12 tons and over when full grown."

Marketing.

The Lothian-grown potatoes are distributed over nearly all the leading markets of Britain. The greater portion, however, is consigned to either Edinburgh, London, Glasgow, Manchester, or Newcastle, in all of which markets Lothian potatoes enjoy an unequalled reputation.

The methods of disposing of the crop are numerous and varied. The much-abused middleman is of course a prominent figure in this part of the business. A very large proportion of the Lothian potatoes are sold by the growers to that class of buyers, only a few in close proximity to the capital being able to get into direct contact with the retail merchants.

Sometimes the produce is sold before the crop has been lifted, but more frequently no bargain is effected until later on in the year, or perhaps until well through the following spring. Many of the leading growers favour the system of selling the crop in

its growing state, and never fail to close with a reasonable offer should such be forthcoming at that stage. The demand for growing crops, however, fluctuates greatly, and it frequently happens that bargain-making before October is impossible at satisfactory terms. The custom of selling the crop before it is lifted naturally incurs heavy risk to both transacting parties. A bargain of this kind—buying potatoes in the drill—practically amounts to selling as well as buying "a pig in a poke," and is at best a speculative method of dealing.

A few remarks by growers on this subject may be of interest. Mr James Hope, who, as already stated, lifts all the crop and sells by weight to agents, says: "We begin about the end of November to send them to London either by ship or train; mostly by ship from Dunbar, which is three miles distant. The train we have on the farm."

Mr George Dods states that "the crop is sent off as required in truck-loads, beginning about the New Year and finishing about March. All the 'ware' is taken by the manager of a store in Edinburgh. The seed, when not required on the farm for planting, is sent into England for planting. The diseased and 'chats' are consumed on the farm."

Mr W. M. Welsh informs me that on his farm "the crop is sold after lifting during the winter to regular customers in Edinburgh, except in the case of some early potatoes, which are sold off the field to allow Italian ryegrass to be sown for early spring use."

Mr W. Renwick "generally sends a few acres of the earlies to Edinburgh, but the great bulk are bought by Glasgow dealers, who send them to London, Manchester, Newcastle, Glasgow, &c." He adds: "The dealers come here after Ayrshire is about finished, or about the beginning of harvest. They buy by the acre."

Mr Andrew Smith sells the earlies when lifted "to dealers for Newcastle and Edinburgh, and the lates after lifting during winter for southern and western markets."

Mr John Dobbie says: "Earlies sold to dealers before lifting. The bulk of the crop is stored and sold as convenient either by cart to Edinburgh or on rail to dealers."

Mr Andrew Renwick generally sells his potatoes "in Edinburgh by the ton just as they are lifted, except the late varieties, which are stored till winter or spring."

Mr R. B. Macdonald sells "immediately as they are lifted to Granton, Newhaven, and Leith shops by the half-cwt. or cwt."

Mr Gavin Jack says his crop is "sold before lifting if possible. Generally the early ones are sold then, going to Glasgow and Edinburgh, and the late ones after lifting either to Glasgow, Edinburgh, or London, according to which is the best market."

Mr John Amour's potatoes are "usually sold by the ton in Edinburgh as lifted."

A Dunbar farmer summarises the custom of his neighbourhood thus: "Sometimes sold by the acre before lifting to London merchants, the farmers lifting them; or sold during the winter by the ton or truck-load to local men who are agents for London salesmen."

Prices.

The market prices for potatoes vary greatly. Indeed the range is so wide and fluctuations so sharp and sudden that only a vague idea can be formed of what the average standard might be. These sudden and extreme changes of value are more particularly noticeable in the neighbourhood of Edinburgh. A suburban grower states that last year (1893) he got from £10 per ton at first to as low as 35s. later on.

Mr James Hope says: "Some years ago I got as much as £8 per ton; the last two years only £3, 10s. per ton; this year (1893) I look for £4."

Mr James Clark has "sold them as low as 1s. 9d. per cwt. and as high as 7s. per cwt." A Dunbar grower fixed the general range of prices for some years past at from £3, 10s. to £5 per ton at the farm. Other quotations are: Mr R. B. Macdonald from £2 to £4 per ton, except a few earlies at £6 per ton; Mr Andrew Renwick from 35s. to £3, 10s. per ton, or from £13 to £21 per acre; Mr Andrew Smith from 35s. to £6 per ton; Mr W. M. Welsh, £3, 10s. per ton; Mr George Dods, £2 to £5 per ton for "ware" and £2 to £4 for seed, all on rail; Mr Davidson, 30s. to £6 per ton, average £2, 10s.; Mr John Dobbie from £12 to £20 per acre—this year (1893) from 35s. per ton on rail in September; Mr W. Park from £14 to £24 per acre; Mr W. Renwick, average from £18 to £20 per acre—sometimes as high as £25; this year (1893) only £13 per acre.

Disease.

The use of anti-blight preparations or disease preventives does not appear to meet with favour in the Lothians. From what I can gather the majority of Lothian growers are rather sceptical as to the value of the reputed remedies.

Neither the *Bouille Bordelaise* nor any other dressing has been tried to any great extent in these counties. Most of the Lothian farmers look to other means for the desired remedy. The method most generally advised is to plant the newer and stronger varieties of tubers, while some emphasise the importance of good cultivation, thorough draining, and the destruction of the shaws of diseased potatoes.

The following remarks may be accepted as representing the prevailing opinion in the Lothians regarding the question of disease, and the suggested methods of remedial treatment:—

Mr James Hope says: "I try to plant those kinds which are free from disease. I do not believe in any application, as it cannot be applied on such a large break as mine. The cure would be worse than the disease. I have seen them done over with the spray—the Highland and Agricultural Society two years ago sent down Dr Aitken to put it on—but it did no good, as we had as much disease on the plots dressed as on those not dressed."

Mr John Amour says: "No remedy that I know of yet can be relied on for preventing disease. I think that all potato-shaws and diseased potatoes should be destroyed if possible, as I have observed that if disease is bad one year we are almost sure to have it next year, if the field is near the one that was diseased the previous year."

Mr James Clark writes: "My opinion about blight is that one should always plant the kind of potatoes known to be the best disease-resisting, and change the seed frequently."

Mr R. B. Macdonald says: "I have always endeavoured to select the most robust varieties for late planting. The early varieties are usually disposed of before disease makes its appearance."

Mr Andrew Renwick says: "My opinion is that it is almost impossible to prevent disease when the climatic conditions are favourable to its development. The early sorts are most liable to disease, and should be lifted if possible before disease takes them."

Mr Andrew Smith says: "I think the safer plan is to grow the hardier and newer sorts, such as Maincrop, the Bruce, &c., and avoid planting too often on the same land. I also believe that deep stirring, and especially subsoiling, helps to mitigate the blight."

Mr George Dods says: "The remedies I have read of may do a little good, but in a season favourable for disease I do not think the crop would benefit much by it, especially the Regents and other early or old varieties."

Mr John Dobbie says: "New and hardier kinds are the only profitable cure in my opinion. This year [1893], notwithstanding the very dry season, I have 15 acres of Regents that will not pay to dress, being (with disease) fit only for feeding. In the Bruce and Maincrop in the same field there is hardly any disease."

The foregoing remarks perhaps contain little that is entirely fresh, but I have endeavoured in the space at my disposal to

present as complete and as accurate an account as possible of the systems of management pursued in the production of the celebrated Lothian potatoes. As the frequent references to the methods adopted on certain farms indicate, I have received much information from many leading farmers, and it is now my pleasant duty to express my indebtedness to them for their valuable assistance.

TECHNICAL EDUCATION IN DAIRYING.

AN ENGLISH EXAMPLE.

By Richard P. Ward, Organising Secretary to the Cheshire County Council.

The enormous competition in all kinds of dairy produce that has been developed during the last twenty-five years, has caused agriculturists to seriously consider how best to meet the foreigner in our markets, and retain the proper share of the trade. A close scrutiny of the methods adopted by our rivals reveals the fact that by a careful attention to details, an intimate study of the character and feeding of the animals, a skilful manipulation of the products, and business-like distribution thereof, has the footing in our markets been obtained and strengthened. In other words, by technical training in the theory and practice of dairying, rather than by any advantages arising from superior land, or tenure, or cheapness of labour, was the result achieved. Thinking men recognise that only by the use of similar methods can the foreign competition be met.

County Council and Technical Instruction.—Several societies and Chambers of Agriculture have made laudable efforts with this end in view, but their organisations have not been sufficient, nor the means at their disposal adequate, for the work to be accomplished. But when, by a happy stroke of fortune, large sums of money were handed over to the County Councils for technical instruction, it was seen that a promising opportunity had arisen for the beginning of a crusade against indifference and "rule of thumb," and for making an effort to place dairying and agriculture generally in their proper positions, as industries that should be conducted upon scientific principles. Nor have County Councils, as a rule, been slow to throw themselves into the work, or parsimonious in the sums set aside for the purpose.

Cheshire Scheme of Technical Instruction.—In the following remarks attention will be directed to the methods adopted in the county of Cheshire—a county depending mainly for its prosperity upon the dairy industry. It was recognised that the subject was at once most important, urgent, and wide in its ramifications, and that to combat the difficulty thoroughly would involve considerable expenditure. It was considered that it would be necessary—

1. To provide good sound theoretical teaching in agriculture.
2. To institute practical work in dairying of an efficient character, and to provide for modern appliances being seen and made known, so that they could be brought into use.
3. To overcome the prejudice and bigotry usually associated with lack of knowledge, and which so often exist in the minds of the multitude against "new departures."

1. *Providing good sound theoretical Teaching in Agriculture generally.*

Lectures.—To meet this, instruction in the shape of lectures was provided on the breeding, selection, and management of cattle, and specially with a view to the proper and most economical feeding of the same, so as to ensure not only a full and copious supply of milk, but milk of a rich quality. Instruction was further provided on the crops of the farm—and especially on the best varieties and courses of grasses, the management of grass-land in general, the use of artificial manures, and the proper place and function and value of roots in the province of feeding and milk-production. None the less important was information on the properties of milk itself: its composition, its liability to admit taint, and hence the extreme importance of cleanliness not only in the dairy itself, but also about the cow.

Lectures on Market-days Unsuccessful.—At first the attempt was made to get audiences of farmers at market-towns on market-days. It was soon found, however, that when farmers "go to market" they go for that purpose only, and cannot be got from their usual haunts and customs to devote themselves to the more serious business of listening to technical instruction on agricultural subjects.

Evening Lectures in Villages.—It was then decided to send the lecturers to the country villages in the evenings. This has been attended with a great measure of success. Various were the motives which stimulated audiences—curiosity, bigotry, opposition, incredulity, all were represented; the most intelligent always being the most attentive and ready to reason, as well as to put information to the test. There is no doubt that, especially as regards dairying and agriculture, technical instruction

has had to gradually work its way downward—from the larger and more intelligent farmers, until at last, by a process of percolation, it gets to those most deficient in knowledge. The result, however, of three seasons' work in providing theoretical instruction is decidedly most encouraging. Not only have large and attentive audiences been obtained, but the questions propounded have shown that a distinct desire for information and a spirit of thinking and inquiry have been aroused.

2. *Practical Instruction.*

To meet this fully, two methods have been adopted:—

(*a*) Itinerant classes.

(*b*) A fixed Dairy Institute provided.

Itinerant Classes.—The itinerant classes are held at farmhouses, at different centres throughout the county. Circulars inviting attendance are issued to all the surrounding farmers and tenantry. The services of Mr Henry Willis, a noted maker of Cheshire cheese, were obtained for the demonstrations in cheese-making. Fourteen classes have been held by him during the past year (1893), each of four days' duration.

The farmer at whose house the class is held provides the utensils and the milk required and retains the cheese made, being indemnified for any loss; but up to the present no such claim has ever been made.

Methods of Instruction.—Mr Willis takes entire control of the evening's milk, and sees the morning's milk added. During the process of cheese-making, short addresses are delivered on the work going forward, and questions answered as to the methods adopted, or in regard to difficulties experienced in the management of the farmer's own products. The numbers attending at each demonstration have been from thirty to forty, all of the right class, and generally as many as the dairy can accommodate. A small charge is made for each person attending.

In the very early part of the season the manufacture of cheese on the "early-ripening principle" is shown, and later on the "medium-ripening" system is adopted. The instructor also gives advice as to the after-management of the cheese, and the best manner of utilising the arrangements and accommodation of the dairies visited. In some places the cheese is made in the old-fashioned round tub; indeed whatever appliances are regularly used are taken advantage of. The supreme importance of perfect cleanliness in everything in the dairy, the avoidance of draughts upon the curd under treatment, the necessity for a uniform and consistent temperature, methods for acquiring a knowledge of the proper degree of acidity, and how to keep it under control, are carefully pointed out and insisted upon; as

also the value of regular and particular turning and treatment in the cheese-room during the process of ripening. Persons are also encouraged to make application for the demonstrator to visit their dairies, and advise upon points of difficulty that may have arisen.

Butter-making.—A similar class of work is also carried on by Mrs Blackshaw, though her demonstrations are generally accompanied during the summer and autumn by classes in butter-making, and in the winter consist of the latter alone. These classes are held at each centre for eight days, a number of churns and butter-workers being supplied, so that the process of butter-making can be performed throughout by the pupils. These classes are held at farmhouses, schools, or public rooms, where the necessary accommodation can be best obtained. A second lady teacher in butter-making classes has been supplied from the Dairy Institute, Worleston.

On each occasion the teacher gives a short address dealing with such questions as the composition of milk, means of ripening cream, how to detect the proper degree of ripeness, methods adopted in obtaining cream, the temperature to be observed throughout, methods of manufacture of butter, and packing for the market. The use of the separator and modern appliances is shown from time to time. The churns and butter-workers used are of the newest pattern, and the use of the "Scotch-hands" insisted upon.

Altogether, classes of this kind have been held in thirty-six centres during the past year. The attendance has been very varied, at some centres very considerable numbers presenting themselves for instruction, though not so large a number as could be wished attended regularly throughout the whole of the days. At the end of the season a public competition in butter-making is arranged, and certificates and prizes awarded to those acquitting themselves to the satisfaction of the examiners.

Result and Cost.—These classes have been the means of carrying instruction in dairying to the remote rural districts, and to the very homes of those interested. In all cases a fixed sum is allowed the person at whose dairy the classes are held, for the use of the premises. The sum set apart by the County Council for these itinerant classes was £600, though the whole of that sum has not been required.

3. *A Fixed Institute for Dairy Instruction.*

It was early considered that a county so deeply interested in dairy-work as Cheshire should possess a fixed Dairy Institute, where regular, continuous, and systematic practical instruction could be given in both cheese- and butter-making, as well as in

the theoretical principles involved — a place to which young persons might go and receive a thorough training in dairy-work, to fit them to undertake the management of dairies themselves, and where they could be boarded and lodged for whatever period they might desire to remain. For the complete success of such an institution it was necessary that a farm should be attached and a sufficient dairy herd maintained, thus giving the complete control of the milk into the hands of the authorities at the Institute. This, it was seen, would involve a very considerable outlay at the commencement, as well as a yearly grant for maintenance.

Equipment and Cost.—A farm of 170 acres at Worleston, near Crewe, consisting entirely of grass-land on a subsoil of clay, was taken from Colonel Cotton Jodrell, M.P., on a lease of twenty years, determinable at the end of the fifth, tenth, or fifteenth year. The landlord agreed to spend a large sum in fitting up the house for the accommodation of pupils, in constructing a room for cheese-making, a cheese oven, a press-house and room in which to place the cheese for ripening, also a separate dairy for butter-making, and piggeries for dealing with the by-products. He was to receive interest at the rate of 5 per cent on his outlay up to a certain sum, any money spent beyond that to be without interest. The latter came to a considerable sum. The house was made to accommodate sixteen students, and the necessary teaching staff and female servants.

A sum of £1500 was granted by the County Council for stocking and acquiring the farm. This amount was supplemented by £500 given by the Cheshire Chamber of Agriculture. In order to thoroughly furnish the house for the students, as also to provide an engine, heating apparatus, cooking ranges, &c., it was found necessary to allow a special maintenance grant for the first fifteen months of £800. A good separator was fixed, and the newest and best appliances both in butter- and cheese-making obtained, so that not only should the students receive the best instruction, but that persons visiting the Institute could inspect and see at work the newest appliances, and have their specialities pointed out and explained.

Staff.—The staff consists of an experienced and capable matron, who has a salary of £50 a-year and board, and on whom devolves the whole of the household arrangements and control of the female servants; a cheese-maker (lady), salary £90 and board; a butter-maker (lady), salary £60 a-year and board; and a farm bailiff, who carries out the instruction of a committee of management. The bailiff receives £60 a-year and board. The workmen required live out in cottages belonging to the farm.

Pupils.—During the year ending March 31, 1894, sixty-four pupils were received, staying various lengths of time, from one

week to a month, and paying a fee of 10s. per week, which included board and lodging; the amount received in fees being £82, 3s. 8d. These pupils included both sexes.

Scholarships.—At the commencement of 1893 an important departure was made—viz., that the six months, April to September inclusive, should be devoted entirely to female students, and the other six months to males, and that three sets of ten scholarships, each tenable for eight weeks, should be granted during the summer months, and two sets of ten scholarships, each tenable for eleven weeks, during the winter months,—such scholarships to be of a value to cover the cost of fees and board and lodging—viz., 10s. per week. Other students were admitted from Cheshire at the same price, those coming from other counties being charged £1 per week. The result has been that during the whole of the year the Institute has been kept entirely filled; indeed, on several occasions some have had to be boarded out. The number of students passing through the Institute during the summer six months, with the length of residence, may be gathered from the following table:—

Less than one full week	20
For one week	26
" two	44
" three	6
" four	5
" eight	31
" nine	2
" twenty-five	1
	135

Of these, 16 were from other counties.

The total sum received in fees by these 135 students has been £227, 7s. 6d., of which £40, 10s. was from the non-county students.

Method of Teaching Female Students.—During the morning the students have had practical instruction in both branches of dairy-work. A certain quantity of milk is set apart daily for butter-making, so that separation and churning take place every day. The teachers give the pupils a course of lessons upon the work carried on, and each pupil is required to take full notes of the instruction given. One of the lecturers employed by the County Council attends once each week to give instruction of a higher and more technical character on the composition of milk and the chemistry of dairying.

At the end of the term an examination, both theoretical and practical, is held, and certificates of proficiency awarded to all showing sufficient skill. The pupils are of all ages from sixteen upwards, and many have been received from other

counties. The arrangement thus adopted secures a longer training for the student, and provides that the work done shall be thorough and practical.

Instruction for Male Students.—During the winter months (October to March inclusive) only males are taken, and as little cheese-making is done during that period, instruction is provided in chemistry, agriculture, mensuration, surveying, book-keeping, and the work of testing samples of milk. This instruction is given by a thoroughly qualified teacher who resides at the Institute, and is responsible for the conduct of the pupils, who range from fifteen to twenty-two years of age.

This system is further designed to test the need for an Agricultural College for the county. The experiment has so far been very successful, the average number in attendance being fourteen, and the total number during the six months thirty. The fees charged are the same as mentioned above for females, and have amounted to £149.

The morning is taken up with dairying and practical work, the afternoon with study, and the evening with preparation of work. An examination in every branch is held at the end of each term.

A laboratory has been built and equipped, in order to provide more thoroughly for instruction in chemistry. For this purpose a special grant of £100 has been made by the County Council.

Maintenance of the Institute.—The grant for the maintenance of the Institute for the past year was £200, a sum sufficient to meet all requirements. Several landlords, recognising the value of the instruction given at the Dairy Institute, have sent several of their tenants for a period, the landlords bearing the expenses. The late Lord Crewe presented any of his tenantry who gained a dairy scholarship with a sum of £1.

The amount received at the Dairy Institute during the year ending March 31st, 1894, was—

For Cheese made during the year	£327	17	7
" Butter " " "	348	5	8
" Pigs fed " " "	244	15	4
" Pupils' fees, and board of special lecturer for 24 weeks	404	14	6
	£1325	13	1

The above for cheese and butter includes what was used in the house.

Records.—Careful records are kept of the quantity of milk used daily, both for butter and cheese; a history, indeed, of each cheese made can be supplied. The prices obtained for butter—viz., 1s. 3d. per lb. (16 oz.) for eight months of the year and

1s. 5d. for the remaining four—prove that, if butter of a reliable character can be regularly supplied, a good price will be obtained.

Experimental Research.—A considerable amount of experimental research on problems affecting cheese-making has been carried on from time to time by Mr A. Smetham, F.C.S. This branch of work will now occupy much more regular attention, as there is no doubt a wide field for useful effort in this direction. Also experiments in feeding are being provided for, so as to test the value of some of the more recent theories advanced. On the farm several experiments in manuring are being carried out.

Influence of the Instruction.—It is a fact often acknowledged by cheese-factors and others, that the quality and value of the cheese made in the county has materially improved during the last two or three years. There can be no doubt that a great portion of this improvement is due to the technical instruction given by the County Council, and the greater care now being given to this important industry, through the special attention being called to it.

EXTENDED INTRODUCTION OF HARDY, USEFUL, AND ORNAMENTAL TREES.[1]

By JOHN BLAIKIE WEBSTER, 100 West Grahame Street, Garnethill, Glasgow.

[*Premium*—£5.]

DURING my career, for a period of some fifty years, as a planter in Great Britain and Ireland, I have paid particular attention to the suitability of several kinds of hardy trees capable of acting as nurses in young plantations. Amongst coniferous species the following are well suited:—

The Balm of Gilead Fir (*Abies balsamea* Miller).—This I have found to be by far the best for the purpose. It is indigenous in Canada, Nova Scotia, and the Northern States of America, and is said to have been introduced to this country about the year 1696. In its native habitat it is said to attain a height of some 30 or 40 feet, but in Scotland and Ireland I have found its average height to be about 25 feet. It grows on a great variety of soils and situations, but attains its best form of

[1] This paper was intended for last year's 'Transactions,' but had to be held over owing to want of space. Its author died in 1893.—EDITOR.

development on cool moor-soil or reclaimed peat-bog, mixed with a small quantity of pulverised clay or earth to increase its firmness and improve its texture. Its great recommendation as a nurse is that in early life it grows rapidly and retains its side branches for shelter until it reaches its full size, by which means it imparts a furnished appearance to belts, and young plantations generally, during the early stages of their growth. Owing to its small size it cannot be recommended as a timber tree; although I have generally realised the same price for its timber as I received for the wood of other coniferous trees, with the exception of larch. In this country it produces cones in great abundance, which are ripe and ready for collecting in early autumn. They should be kept till spring, when the seed should be extracted, sown on nursery seed-beds, and treated like that of the common Silver Fir (*Abies pectinata* Loudon). It is, unfortunately, only hardy in the milder parts of the British Isles.

A. nobilis Lindley.—This tree combines the useful and ornamental to a large extent, and since its introduction into this country from North America and Northern California, in 1831, has proved not only to be thoroughly hardy, but also to rank as a first-class tree for ornament and utility. Many years ago, when planting trees and carrying out large and extensive improvements for the late Prince Consort at the Highland home of the Queen, I found that this tree was well suited for growing on dry gravelly ground of a free open texture resting upon shingle. Although the situation is high and exposed, the pure mountain air seems to agree with it; and as it does not start growth in early spring, I have never seen it cut down by late spring frosts, which is a great recommendation to it as compared with some other species of the *Abies* tribe of trees.

But although the tree appears to be quite at home in the Highlands of Scotland, yet it is by no means confined to such parts, as I have grown it to great perfection from home-saved seed in the Lough Neagh district of Ireland.

There seems to be an idea that seedlings raised from the seed of young trees of this species are always of a weak constitution as compared with those raised from the seed of trees in a more advanced stage of development; but I have not found this the case, as trees which I raised from the seed of young trees thirty years ago are in perfect health, and making rapid progress on a great variety of soils and situations.

Young trees of this species are apt to produce, at first, a larger number of cones than of male catkins; consequently I have found it necessary to collect the pollen on a piece of paper and introduce it into the cones with a small camel-hair pencil, in order to make sure that the seeds were fertilised; but when

the trees attain a pretty good size they generally produce cones and male flowers in more equal numbers, so that artificial fecundation is unnecessary.

In this way I have raised many fine trees, since 1862, on the estate of Churchill, Verner's Bridge, Ireland; and their being in perfect health seems to indicate that the theory of such trees being degenerate and wanting in stamina is without foundation. The cones, which are of a pretty large size, are ripe and ready for collection in early autumn; and as they are deciduous, this should be attended to at the proper time in order to prevent the seeds from being shed and lost. Each cone contains about 500 seeds; these should be sown broadcast in the month of April, on seed-beds about 4 feet wide, formed upon well-worked soil, of a free, open, sandy texture, and clear of weeds; and as the seeds are of a pretty large size, they should be sown rather thinly, to allow the plants space to branch out. Press the seeds down on the surface with the back of a spade or light roller, and finish by covering them with about half an inch of fine soil. When the plants have been two years in the seed-bed they should be removed and planted into nursery-lines 12 inches asunder, the plants being about 6 inches apart in the rows. Here they should remain for a couple of years; and if well handled, they may then be planted out in the forest where they are to remain; but in cases where a larger size of plants is wanted, they had better be transplanted a second time and allowed additional space for their further development.

In rearing young trees for ornament and utility, the culture of their roots in the nursery is a matter of vital importance to success; so that painstaking in this respect is not lost. The following method of rearing this tree has been practised by me with the most happy results. Taking it for granted that the ground has been thoroughly prepared, stretch a line along the surface; with a spade cut out a sloping notch along both sides of the line, by which means the opening for the plants forms a small ridge, place the plants at regular distances apart along this ridge, spreading their roots out in a regular and uniform manner on both sides of the ridge, and then covering them with fine soil.

The advantage of this system is that the roots are trained in a regular manner all round from the base of the stem, consequently they can collect food from all quarters; and as the tree is thus anchored firmly to the ground, it is not liable to be overturned by wind blowing from any point of the compass. This is, no doubt, a little extra trouble, as compared with the plan of cutting a perpendicular opening along one side of the line, and placing the plants against the bank thus formed, with the roots all one way; but the superior roots resulting from the former system will compensate for the extra trouble.

In preparing ornamental trees for planting I have practised this plan for many years, and do not recollect a single tree grown in this way having been upset by the wind, which cannot be said of trees that had been planted without the roots being properly spread out.

A. nobilis grows in a great variety of soils, provided that they are dry and free of stagnant water; but in cases where the subsoil is of a hard impervious nature, it should be well broken up and pulverised with a pick before planting the trees. It is likewise an advantage to allow the ground to lie exposed to the influence of the weather for a considerable time before the trees are inserted. Stiff adhesive clay soil is unsuited to the growth of the tree; but it thrives very well on reclaimed peat-bog mixed with a little soil or clay at the spots where the trees are to be planted.

Abies Webbiana Lindley (Webb's Indian Silver Fir).—This fine tree was introduced into this country in 1822. In its native habitat on the Himalayan mountains it attains a height of some 120 to 150 feet, but in this country I have never seen it approach that size. The shape of the tree, however, when fully established and loaded with its beautiful purple- or violet-coloured cones, is highly attractive; and although in this country it cannot be recommended as a profitable timber tree, owing to its liability to be cut down by late spring frosts, yet when once established as a standard tree on the lawn it yields to no other of the tribe to which it belongs.

It is propagated from seed in the same way as *A. nobilis*, but I have reproduced it by layering the side branches before the tree produced cones.

It is rather curious that some of the trees raised from layers produced cones when they were only about 4 feet high. The tree attains its best form of development in this country when planted on an inorganic soil, well broken up, and on a northerly exposure. Peat-bog and soft soil, rich in organic matter, in hollow places, attract frost, and are therefore unsuited to it. The proper selection of soil and site for this tree mainly determine whether the planting is to be a success or a failure.

A. Nordmanniana Spach (Nordmann's Silver Fir).—This fine species was introduced into this country from the Crimean mountains in 1845, and has not only proved to be thoroughly hardy in Great Britain and Ireland, but likewise to combine the useful and ornamental in a marked degree. Although it is a mountain tree, yet at high elevations in this country it does not thrive well when planted on gravelly or clay soil principally composed of inorganic matter. The finest trees of this species that I have ever seen I planted on reclaimed Irish peat-bog about thirty years ago. It thrives best on soils and in situa-

tions the very converse of those given for *A. Webbiana*. After it attains a height of about 25 feet it produces cones freely, and its propagation from seed effected in the manner described for *A. nobilis*.

A. cephalonica Loudon (the Mount Enos Silver Fir).—This interesting species was introduced into this country from Mount Enos in 1824, and as it is liable to be cut down by late spring frosts it should not be planted on low-lying damp situations. It thrives best on clay loam, resting upon a cool clay subsoil, well broken up, and on a northern exposure. When well established it makes a fine specimen for the park or lawn. Its habit of growth is rather spreading, and when it attains a height of some 30 feet it produces strong side branches at the top, which give it a shape different from that of any other species of the *Picea* tribe. At this stage of its growth it produces cones and fertile seeds freely, and its propagation is effected in the manner described for other species of Conifers.

A. lasiocarpa Hooker (the Woolly-scaled Silver Fir).—This very distinct and hardy species was introduced into this country in 1860, from Northern California, where it is said to attain a height of some 200 feet. In Great Britain and Ireland it grows on all classes of soil, including reclaimed peat-bog, and is therefore worthy of being planted extensively both for ornament and profit. In the Highlands of Scotland it appears to be at home when planted on gravelly soil resting upon shingle. It is not so apt to produce cones in early life as some other species of the *Abies* tribe.

A. Pinsapo Boissier (the Pinsapo Silver Fir).—This fine ornamental species was introduced into this country in 1838, from Spain, where it is said to attain a height of 60 or 70 feet. It cannot be recommended as a timber tree in this country, but when planted on good soil it makes a handsome specimen for the park or lawn. It thrives remarkably well on dry calcareous soil, but should not be planted on peat-bog, as when grown on such a soil it is rather an eyesore than an ornament.

A. sibirica Ledebour (the Pitch or Siberian Silver Fir).—This small ornamental tree was introduced into this country in 1820, from Siberia, where it is said to attain a height of 40 feet; but in this country I have never seen it approach that size; but when planted on suitable soil, it makes a good specimen tree of small size. It attains its best form of development in this country when planted on a northern exposure, on hard inorganic soil well broken up and pulverised. Soft mossy soil and peat-bog are unfavourable to its growth, and it should never be planted on low-lying damp situations on account of its liability to be cut down by late spring frosts.

Pseudotsuga Douglasii Carrière (Douglas's Spruce).—This fine timber tree was introduced into this country from North-West America, California, and the Rocky Mountains, about the year 1827, and has proved to be an acquisition in many respects. In its native habitat it is said to attain frequently a height of about 200 feet. In this country it grows best when planted in sheltered situations where the soil is of a loose friable nature and rich in organic matter. It makes very slow progress when planted in cold wind-swept heather-ground, but thrives very well on flat peat-bog in sheltered situations. About thirty years ago I planted this tree on peat-bog about 30 feet deep at Verner's Bridge, Co. Armagh, Ireland, and the trees are now magnificent specimens, making rapid progress. The bog in this case was thoroughly drained and allowed time to drip and cleanse itself from impurities before planting was commenced, and at the time of planting a small quantity of earth or pulverised clay was mixed with the staple at the spots where the trees were put in. In this country it produces cones and fertile seed freely, and its further extension is very desirable.

Tsuga Mertensiana Carrière (Prince Albert's Spruce).—This species is also known in some collections as *A. Mertensiana.* It is a native of Alaska, Oregon, and British Columbia, and is said to attain a height of from 100 to 150 feet in its native habitat. Its shape, when fully established, is something like the Hemlock spruce (*T. canadensis*), but with this difference, that its growth is more upright and less spreading. It thrives remarkably well on loamy soil, resting upon a clay subsoil, thoroughly broken up, as well as on reclaimed peat-bog. From the appearance of some which I planted twenty years ago, I have every reason to believe that this tree will prove a desirable one, whether grown for ornament or profit.

P. orientalis Carrière (the Eastern Spruce).—This handsome tree is indigenous to the Crimean mountains and other places in the vicinity of the Black Sea, where it is said to attain the height of some 60 or 80 feet. In this country it is of rather slow growth, but makes a grand specimen tree for the park or lawn when well established. It was introduced into this country in 1825, and I have planted it with success on any ordinary soil, including peat-bog. It cannot be recommended as a timber tree to be grown for profit.

P. nigra Link (the Black American Spruce).—This hardy species is a native of Canada and the United States, where it is said to attain a height of some 60 or 80 feet. It was introduced into this country in 1700; and although it has proved to be perfectly hardy, yet it is of too slow a growth to be recommended as a timber tree. I have, however, planted it both for ornament and profit in the natural birch forest, on

Irish peat-bog, where it thrives admirably; and as its shape in such places is almost cylindrical, I could sell almost any number of trees for ladder-poles: its timber, when cut up, is strong, light, and elastic, and hence its suitability for such purposes. Its leaves and twigs are often used for making spruce-ale. When planted in open airy situations it makes a fine small specimen tree for the park or lawn. It should always be planted on soft soil rich in organic matter.

Pinus insignis Douglas (the Remarkable Pine).—This fine ornamental tree is indigenous to California, and was introduced into this country in 1833; but its hardiness, unless in maritime situations, cannot be depended on. Even in Ireland I have known it killed by frost after it had attained a height of 20 feet. In places, however, where it does succeed, it makes a good specimen tree for the park or lawn, and is therefore worthy of the attention of the planter. It should not be planted on low-lying ground of a damp boggy nature, as in such places it is apt to be cut down by late spring frosts. It thrives best on a northern exposure, on loose open soil well mixed with inorganic matter.

P. ponderosa Douglas.—This tree combines the useful and ornamental to a large extent, but, like the Douglas spruce, it should not be planted on cold wind-swept heather-ground. It is a native of California, where it is said to attain a height of 200 feet or more. It was introduced into this country in 1847; and although it has proved to be hardy as regards frost in most parts of the country, yet it requires to be planted in a sheltered situation. It must not, however, be too confined, as it is apt to become drawn-up—*i.e.*, the girth of stem is not in proportion to its height. It thrives best on a loose open soil, thoroughly dry; but peat-bog and damp soils are unfavourable to its growth.

P. Pinaster Aiton (the Cluster-coned Pine).—This tree cannot be said to be of recent introduction into this country, as it has been cultivated in Great Britain and Ireland for many years, and has proved to be a tree of fair utility. My reason for referring to it in this paper is to correct an error which I have repeatedly seen in print—namely, that the tree will not grow to a useful size as a timber tree on peat-bog or cold clay soil. Upwards of thirty years ago I planted this tree on deep peat-bog and stiff adhesive clay at Verner's Bridge, Ireland, and the trees, as far as health and growth are concerned, are all that could be desired, many of them being of a larger size than Scotch fir and spruce planted at the same time in the same plantations. The fact is that the *Pinaster* has the faculty of accommodating itself to all classes of soils and situations, from the sea-shore inwards and as far upwards as trees can be grown

for profit. These remarks may likewise be applied in a great measure to the Black Austrian Pine (*P. austriaca* Hoss) and the Corsican Pine (*P. Laricio* Pairet).

P. excelsa Wallich (the Lofty Bhotan Pine).—This fine timber tree was introduced into this country from Nepal, Bhotan, and other places in Northern India, in 1823, and has proved to be thoroughly hardy and of rapid growth on both marsh and mountain ground. In its native habitat it is said to attain the height of 150 feet, and from its rapid growth here it has every appearance of being a first-class timber tree. In addition to its merits in this respect, it makes a grand specimen tree for the lawn; and when allowed plenty of space, it retains its side branches down to the ground.

P. parviflora Siebold and Zuccarini (the Small Japan Pine).—This pretty little pine is indigenous to Japan, where it is said to attain a height of from 20 to 25 feet; but the best specimens I have grown in this country are little more than half that size, after a growth of some thirty years. It is quite hardy, and thrives on any ordinary soil, provided it is dry. It produces cones and fertile seed in this country freely. The cones are deciduous, about 2 inches long, slightly tinged with a purple colour, which gives them an ornamental appearance. The seeds are ripe and ready for collection in early autumn, but if not looked after at the proper time they will be shed and lost. The seeds should be sown on light sandy soil in spring. The tree is best adapted for planting on the lawn as a specimen, or elsewhere when space is limited.

Sequoia sempervirens Endlicher (the Californian Redwood Tree or Bastard Cedar).—This giant tree was introduced into this country from Upper California in 1825, and has proved to be tolerably hardy in many parts of Great Britain and Ireland, where the site is moderately sheltered from cold cutting winds. It prefers a loose open soil rich in organic matter, and some of the best trees of this species I have ever planted are growing on deep peat-bog, where a little soil was mixed with the staple at the spots where the trees were put out. It should not be planted on cold stiff clay, nor on cold wind-swept situations. When it becomes thoroughly established it presents a grand appearance; the bark on the stem is soft, corky, and deeply furrowed. I cut down a tree of this species that had been damaged during a storm, and found that the stool left in the ground produced shoots round its margin—rather an uncommon thing among coniferous trees. When the wood of the stem was cut up, it was found to be of a close firm texture, which induces me to believe that the wood of old mature trees grown in this country will prove very valuable.

C. macrocarpa Hartweg (the Large-fruited Cypress).—Said

by some to be the same as *C. Lambertiana* (Gordon). Without entering upon debatable ground, I may be allowed to give my experience of these trees. In 1862 I had both kinds growing in mixed plantations at Verner's Bridge, Ireland, and after they had attained the height of some 6 or 8 feet, every tree of *C. macrocarpa* was killed by frost, while *C. Lambertiana* stood scathless. This is, I think, pretty good evidence that the trees are not the same species; and further, their shape is very dissimilar. *C. macrocarpa* has a rather conical habit of growth, but slightly spreading, while *C. Lambertiana* produces long, flat, horizontal branches, clothed with leaves of a darker green colour than the former. Both species may be planted with fair success near the sea-coast; but *C. Lambertiana* thrives also in cold inland districts, and appears to be both ornamental and profitable. Both trees should be planted on rich soil of a free open nature; but peat-bog and cold stiff clay are unfavourable to their growth.

C. Lawsoniana Murray (Lawson's Cypress).—This useful and ornamental tree was introduced into this country from Northern California about 1855, and has not only proved to be thoroughly hardy, but likewise one of the most ornamental and profitable trees recently introduced into this country. Upwards of twenty years ago I raised a large number of seedlings from home-saved seed, and although the seed was all collected from the same tree, the progeny exhibited great variety in size, shape, and habit of growth. When forming a new plantation I planted a number of the best of those trees mixed with Scotch fir, larch, and other species, and after a growth of twenty years in their new quarters their appearance as timber trees has realised my most sanguine expectations. This plantation comprises an area of about 13 acres, in the vicinity of Anagariff Lake, Co. Armagh. The soil is of three classes—namely, stiff clay, gravelly loam, and peat-bog. The trees on gravelly soil and peat-bog are pretty uniform in size, but on clay ground the Scotch fir has taken the lead, and is about one-third larger than the larch and cypress, showing that stiff adhesive clay is unfavourable to the development of both these species. Trees of Lawson's cypress which I have cut up for use after a growth of thirty years show that the wood is of good average quality, and I have no hesitation in recommending this tree to be planted both for ornament and profit.

Thuya gigantea Nuttall (the Tall Arborvitæ).—This fine tree is also known as *T. Lobii* (Veitch), and was introduced into this country from California in 1854. It has proved thoroughly hardy in Great Britain and Ireland. It is a tree of rapid growth, thrives on all classes of soils and situations, including stiff clay and reclaimed peat-bog. From its hardiness and rapid

growth I consider it one of the best trees recently introduced, and should the timber of old and matured trees prove to be of good quality, it cannot fail to attract the attention of planters as a substitute for larch in parts of the country where that tree has proved a failure. Its habit of growth is sharply conical; the stem is as straight as an arrow, and exhibits very little taper. Its average annual rate of height-growth is about 30 inches.

Cupressus nootkatensis Lambert (the Nootka Sound Cypress).—This fine hardy tree is also known as *Cupressus nutkaensis* (Hooker). It was introduced into this country in 1851, and is not only hardy but capable of growing on all classes of soil, including clay, if well broken up, and peat-bog. In 1861-62 I had a great many trees of recent introduction killed by frost, but this tree stood unscathed. Twenty years ago I planted some of these trees in a natural plantation of birch, where the soil is peat-bog, and they are now splendid specimens, about 20 feet high, and well furnished with branches down to the ground. Although the rate of growth is less than that of some other species, yet the tree yields to none as an ornamental species.

Unlike some others of the Cypress tribe, the cones are sessile, or nearly so, and arranged in single file here and there along the branches and twigs, where they remain for two years before they reach maturity; consequently there are always two sets of cones on the tree at one time. Collectors of seed should keep this in view, and only select the ripe cones, which may be known by their dry brownish appearance, as compared with the young cones, which are of a greenish colour, hard, and succulent. Both sets of cones are about the same size and shape, and nearly as large as a small bullet. The tree can be propagated either from seed or from cuttings, but the plants raised from seed are generally the best.

Cryptomeria japonica Don (the Japan Cedar).—This handsome tree is a native of Japan and parts of the north of China, where it is said to attain a height of from 60 to 100 feet. It was introduced into this country in 1844, and has proved to be tolerably hardy. It, however, prefers a sheltered situation, and should be planted on rich loamy soil of a free open nature, resting upon a clay subsoil, well broken up with a pick. It should not be planted on reclaimed peat-bog nor on low-lying marsh-ground, as in such situations the young wood is generally soft, and wanting in firmness to stand the winter and spring frosts. I have cut up the wood of this tree for use, and found it to be rather soft, but firm and well packed, and quite workable. Paling-stobs made from the wood of this tree and driven into the ground last as long as Scotch fir. As it can only be grown on

certain soils and situations, it is not to be recommended in this country as a timber tree, but is worthy of a place in all cases where ornament, contrast, and variety are desired.

Cedrus atlantica Manetti (the Mount Atlas Cedar).—This hardy tree is indigenous in Barbary and other parts of Northern Africa, where it is said to attain a height of from 70 to 100 feet at an elevation ranging from 7000 to 8000 feet. It was introduced into this country about the year 1845, and has proved to be not only thoroughly hardy, but likewise a tree of rapid growth on the most exposed situations. I have planted it with success on all classes of soil, but stiff clay and hard inorganic soil should be well broken up with a pick previous to planting.

Peat-bog, on the other hand, requires a small quantity of earth or clay mixed with the staple at the spots where the trees are to be planted. This class of ground should always be planted in spring, when the plants are just commencing to grow. When planted in autumn, the cold peat damages the roots, while lying in a dormant state during winter, to such an extent that they often die or take several years to recover their vitality. Its rate of growth when fully established is similar to that of the larch.

Sequoia gigantea Torrey (the Mammoth Tree).—This giant tree was introduced into this country from Upper California in 1853, and has proved to be hardy in most situations, but it prefers good deep soil and a sheltered situation. Much has been said and written regarding the growth and size of this tree in its native habitat, but in this paper we will confine our remarks to our experience of it in this country. Thirty years ago I planted a number of these trees on different soils and situations, and found that peat-bog and stiff clay were unfavourable to its growth.

The best trees are found on deep loamy soil in a sheltered situation, the stems having now an average girth of from 7 to 8 feet at 1 yard from the ground. The trunk of a timber tree should be cylindrical in shape, but the trunk of the *Wellingtonia* is by no means so, and all the trees of this species which I have seen have the same fault. The shape is sharply conical, the branches having rather a bare unfurnished appearance, admitting glimpses of the rough furrowed bark on the stem to be seen here and there; and this gives the tree an attractive appearance.

Its merits lie between the ornamental and the useful; but, like other coniferous trees which I have noticed in this paper, it is unsuitable for planting up heather-ground on cold windswept situations. It produces cones and fertile seed in this country with great freedom; these I have sown in nursery seedbeds and treated like those of the common larch.

Cupressus thyoides Linnæus (the Ground Cypress).—This tree is a native of the United States and Canada, and is said to be found principally on marshy ground, where it attains a height of from 60 to 80 feet; but although it was introduced into this country in 1736, a good specimen tree is very rarely seen. This arises in a great measure from the fact that the trees are generally planted on a dry soil, principally composed of inorganic matter. The best trees of this kind which I have ever grown are planted on reclaimed Irish peat-bog, mixed with a little soil at the spots where the trees are planted.

There are several varieties in cultivation, the best of them being *C. variegata*, the green foliage of which is finely mixed with golden spray; and when planted on moss or marshy ground, and well established, it has no rival as an ornamental tree among the variegated conifers. It prefers a sheltered situation, as it is rather impatient of wind, and when planted on congenial soil it soon forms a beautiful specimen tree of a medium size, with a conical habit of growth, and well furnished with side branches down to the ground. It is perfectly hardy, and is propagated both by cuttings and from seed.

J. drupacea Labillardière (the Plum-fruited Juniper).—This is thought by some to be the finest of all the juniper tribe; but be that as it may, it is certainly a very distinct species and highly ornamental. It is a native of the north of Syria and Asia Minor, and some writers tell us that in these parts it attains a height of from 10 to 15 feet, while others give its height at 30 feet; but the best specimen I have ever planted at Verner's Bridge, Ireland, is only about 20 feet high, after a growth of upwards of thirty years.

It was introduced into this country about the year 1820, and has proved to be hardy in most situations; it prefers a sheltered site, but is impatient of the close proximity of other trees. It should not be planted on cold stiff clay, nor on peat-bog; but any ordinary soil that is naturally dry, or rendered so by efficient drainage, and well broken up at the time of planting, is suitable to it. It has a columnar habit of growth, and makes a good though small specimen tree for a grass lawn.

J. chinensis Linnæus (the Chinese Juniper).—This pretty little tree is one of the hardiest of the hardy; at all events I have never known it cut down or even seared by frost, even though planted on cold wind-swept situations. It is admirably adapted for planting as a specimen on a grass lawn, and will grow on all classes of soil, including peat-bog if well prepared. When fully established, its shape is tapering, and it is well furnished with side branches down to the ground, the foliage of which is occasionally glaucous, and sometimes bright green; but both colours are often to be found on the same

tree. In early spring it produces its pretty golden catkins in great abundance: these contrast finely with its foliage, and render the tree highly ornamental at that season.

Cephalotaxus drupacea Siebold et Zuccarini (the Plum-fruited Cephalotaxus).—This highly ornamental little tree is a native of Japan and the north of China, where it is said to attain a height of some 30 feet. In this country it is quite hardy, but prefers a sheltered though not confined situation, as otherwise it is apt to become drawn-up and to have a bare lanky appearance. It thrives on all classes of soil, including reclaimed peat-bog, provided that they are dry and well broken up. When fully established, its shape is that of a small well-furnished tree, clothed with glossy green leaves about 1 inch long and arranged in two rows along the branches and twigs. Its rate of annual height-growth under favourable circumstances is from 6 to 8 inches. It is well adapted for planting on a grass lawn as a small specimen tree.

C. Fortunei Hooker (Fortune's Cephalotaxus).—This interesting species is likewise indigenous to different parts in Japan and the north of China, where it is said to attain a height of some 50 or 60 feet. It was introduced into this country about the year 1848, and has proved to be tolerably hardy; but, like the last-named species, it prefers a sheltered situation, and grows on all classes of well-prepared soil. It has a conical habit of growth, and is well furnished with side branches, which are clothed with leaves from 2 to 3 inches long, of a glossy green above and a glaucous whitish colour below. Its average rate of annual height-growth on good soil in a sheltered situation is from 8 to 10 inches.

C. pedunculata Siebold et Zuccarini (the Long-stalked Cephalotaxus).—This is another ornamental species from Japan, where it is said to attain a height of some 25 feet. It is thoroughly hardy.

Remarks.

Practical experience and observation tell us that there is a close connection between trees and the kind of soil and situation in which they attain their best development; and when this is kept in view and practised by the planter, it will be found to form the basis of successful tree-culture. No doubt some species of trees are capable of accommodating themselves to a greater variety of soils than others; and in this paper the writer has given the results of his experience in this respect, gathered during many years over a wide range of country in Great Britain and Ireland, and under very different conditions as regards soil and climate.

Another point of much importance, as a means of attaining

success in the culture of exotic and other ornamental trees, is that of providing shelter on cold exposed situations, after the trees have been planted out where they are to remain, and until such time as they become established and inured to the climate of their new locality.

It is likewise a point of much importance to have the roots spread out in a regular and uniform manner, without crossing each other, by which means they can collect food from all quarters, and at the same time anchor the tree firmly to the ground, and thus enable it to withstand a storm blowing from any point of the compass.

RELATIVE FEEDING VALUE OF TURNIPS GROWN WITH AND WITHOUT NITRATE OF SODA.

By A. S. Logan, Ferney Castle, Reston.

The very large crops of turnips grown by the use of nitrate of soda in Mid-Lothian, Lauderdale, and elsewhere, in competition for prizes offered by the Nitrate Committee, suggested to me the inquiry, *Are turnips so grown of as good feeding quality as those grown without its use?* The following experiments were undertaken with the view of answering this question.

Experiment in 1892.

Soil.—The land on which the turnips to be used in the experiments were grown is a red clay loam of a peculiar plastic nature, with a northern exposure.

Manures.—In 1892 the manure applied was as follows: Plot 1 at the rate of 4 cwt. per acre of a mixture containing 2 parts vitriolated bones, 2 parts superphosphate, 1 part steam bone-flour. No. 2 plot at the rate of 5 cwt. of Thomas phosphate powder and 1½ cwt. nitrate of soda. Both plots also received sixteen loads farmyard manure,—all the above being applied in the open drills on 9th June, on which date also the turnips (Fosterton Hybrid) were sown. On 21st July, No. 2 plot received a top-dressing of nitrate of soda at the rate of 1½ cwt. per acre. The turnips were lifted on 16th December, and yielded—

	tons	cwt.	qr.	
Plot 1	21	15	2	per acre.
" 2	25	17	0	"

Hoggs for the Experiment.—On 27th December I selected twenty three-quarters-bred hoggs from my feeding flock, and having been divided into two lots of ten each, they were folded on a lea-field. Each lot had a fold 25 yards square, and a removal was made to fresh ground every fortnight.

Food Rations.—Turnips were supplied *ad libitum*, and each lot had 5 lb. Ovens' lamb-food per day, and a supply of chopped hay, the quantity of this varying with their demand for it—the same quantity always being given to each lot. During stormy weather 14 lb. of hay were consumed by each lot, but in dry mild weather the quantity was very small.

Results.—The sheep were weighed at intervals during the experiment, which continued till 4th April 1893, when they were slaughtered and their carcass-weight ascertained.

Considerable difficulty was experienced in keeping the feet of the sheep in a sound condition, and it was noted that those fed on the turnips grown with nitrate of soda were more difficult to keep in order than the other.

The following are the results of 1892 experiment:—

	Lot 1, fed on turnips grown without nitrate of soda. lb.	Lot 2, fed on turnips grown with nitrate of soda. lb.
Live-weight—		
27th December 1892	1007	1007
28th January 1893	1181	1149
8th March 1893	1231	1183
4th April 1893	1327	1271
Total gain in live-weight	320	264
Total carcass-weight	689	654

Consumption of Turnips.—The quantity of turnips consumed by each lot was practically the same, viz.:—

	tons	cwt.	qr.
Non-nitrated	10	0	2
Nitrated	10	0	3

Analysis of Turnips.—Samples of the turnips were sent to Dr Aitken for analysis, with the following result:—

	Not nitrated.	Nitrated.
Water	92.30	92.58
Albuminoids	.59	.71
Amides, &c.	.18	.34
Carbohydrates	5.52	4.98
Woody fibre	.77	.72
Ash	.64	.67
	100.00	100.00
Containing sugar	3.64	3.33

Experiment in 1893.

Having submitted the results of the above experiment to Dr Aitken, I was advised by him to conduct a similar experiment with crop 1893, selecting turnips which had all received the same manure, and that so many drills should receive, in addition, heavy top-dressings of nitrate of soda.

Manures.—The turnips to be used in 1893 experiment were sown on 31st May, and manured at the rate of 5 cwt. per acre with a similar mixture to that used on Plot I. in 1892. No dung was applied in 1893. Twelve drills were top-dressed with 1½ cwt. nitrate of soda on 13th July, and again with a similar quantity on 4th August.

Yield of Turnips.—The turnips were lifted on 21st October, and yielded—

	tons	cwt.
Nitrated	18	11
Non-nitrated	17	8

The very dry season had evidently prevented the nitrate from exerting its full effect, although the leaves of the twelve drills kept of a dark-green colour when the others were quite yellow.

"*Finger-and-Toe.*"—Finger-and-toe appeared in the upper portion of the field, and this part was cut off, and not used either in calculating the weight per acre or in feeding to the sheep under experiment. I was in consequence only able to store 5 tons 19 cwt. off the nitrated plot for use.

Shrinkage in Storage.—It may be noted here that, although stored in perfectly dry condition and clear of earth, they only weighed 5 tons 8 cwt. when used. It would have been interesting to note whether this shrinkage was greater than in the non-nitrated turnips, but unfortunately I had only added roughly to this pit to make it nearly equal to the other.

Results.—The feeding experiment was conducted in exactly the same way as in 1892, but the lesser quantity of turnips available shortened the duration of the experiment. The following are the results:—

	Lot 1, fed on turnips grown without nitrate of soda. lb.	Lot 2, fed on turnips grown with nitrate of soda. lb.
Live-weight—		
24th October 1893	878	879
6th January 1894	1099	1108
Total gain in live-weight .	221	229
Total carcass-weight . .	552	535

Samples were sent to Dr Aitken for analysis, with the following results:—

	Not nitrated.	Nitrated.
Moisture	91.12	92.06
Albuminoids	.47	.66
Amides, &c.	.25	.24
Carbohydrates	6.49	5.44
Woody fibre	1.06	.93
Ash	.61	.67
	100.00	100.00
Containing sugar	6.12	5.44

The peculiarity to be noted here is that although the live-weight of lot 2 on 6th January, and also the appearance of the sheep, both pointed to their carcass-weight being greater than lot 1, it was found that the latter exceeded the former by almost $1\frac{3}{4}$ lb. per sheep.

Conclusion.

From these experiments it will be seen that the question asked at the beginning of this paper—Are turnips grown with nitrate of soda of as good feeding quality as turnips grown without it?—has been answered in the negative, so far as sheep are concerned. It should again be noted, however, that no more turnips were eaten in the one case than in the other, so that the extra quantity grown per acre by the use of nitrate would have been available for a longer time. In the first experiment this would have been three weeks; and during that time, according to the rate of increase of live-weight, the sheep would have equalled the others, but there would still have remained the feeding value of the artificial food consumed against the nitrated turnips.

THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1893, AND METEOROLOGY OF THE YEAR RELATIVE THERETO.

THE CROPS.

The following comparison of the cereal and other crops of 1893 with those of the previous year, has been prepared from answers to queries sent to leading agriculturists in different parts of the country.

The meteorology of the year has been furnished by Dr Alexander Buchan, Secretary of the Meteorological Society of Scotland.

The queries issued by the Secretary were in the following terms:—

1. What was the quantity, per imperial acre, and quality of grain and straw, as compared with last year, of the following crops? The quantity of each crop to be stated in bushels. What quantity of seed is generally sown per acre?—(1) Wheat, (2) Barley, (3) Oats.
2. Did the harvest begin at the usual time, or did it begin before or after the usual time? and if so, how long?
3. What was the quantity, per imperial acre, and quality of the hay crop, as compared with last year, both as regards ryegrass and clover respectively? The quantity to be stated in tons and cwts.
4. Was the meadow-hay crop more or less productive than last year?
5. What was the yield of the potato crop, per imperial acre, as compared with last year? The quantity to be stated in tons and cwts. Was there any disease? and if so, to what extent, and when did it commence? Were any new varieties planted, and with what result?
6. What was the weight of the turnip crop, per imperial acre, and the quality, as compared with last year? The weight of the turnip crop to be stated in tons and cwts. How did the crop braird? Was more than one sowing required? and why?
7. Were the crops injured by insects? State the kinds of insects. Was the damage greater or less than usual?
8. Were the crops injured by weeds? State the kinds of weeds. Was the damage greater or less than usual?
9. Were the pastures during the season of average growth and quality with last year?
10. How did stock thrive on them?
11. Have cattle and sheep been free from disease?
12. What was the quality of the clip of wool, and was it over or under the average?

From the answers received, the following notes and statistics have been compiled:—

EDINBURGHSHIRE. *Wheat.*—About 48 bushels; fine quality; straw about the same as last year; 3 bushels seed sown.

Barley.—About the same as last year; 44 to 48 bushels; quality finer than last year; 3 bushels seed sown.

Oats.—Fully a better crop than last year; straw shorter; 48 to 52 bushels; seed sown 4 bushels.

Harvest.—Commenced 14th August, about three weeks sooner than last year.

Hay.—Very light crop, about 2 tons 5 cwt.; fine quality. Excellent

second crop, of which a great quantity was secured in fine weather for seed. *Meadow-hay*—Very good crop; quality not so good as last year.

Potatoes.—Very good crop. Regents very much diseased; Bruce and Maincrop quite sound; about 8 tons.

Turnips.—Very heavy crop; quality better than last year. Yellows, 30 to 40 tons; swedes, 20 to 30 tons; only sown once.

No damage from insects or weeds.

Live Stock.—Pastures better than last year; stock throve on them and fattened well, and were quite free from disease. *Clip of wool*—About the average; wool same price as last year.

LINLITHGOWSHIRE. *Wheat.*—About the same in quantity, but better in quality as compared with last year; from 30 to 40 bushels; seed from 2½ to 3 bushels.

Barley.—Better in quantity and quality as compared with last year; from 30 to 40 bushels; seed from 2½ to 3 bushels.

Oats.—Better in quantity and quality of both grain and straw as compared with last year; from 30 to 40 bushels; seed from 4 to 6 bushels.

Harvest began and ended a month earlier than last year.

Hay.—About the same in quantity, but not so good in quality, as last year; from 1½ to 3 tons. *Meadow-hay*—Good, but very little grown in the district.

Potatoes.—Better in quantity and quality as compared with last year; very little disease; from 6 to 10 tons.

Turnips.—Much better than last year; from 15 to 30 tons; brairded well, and very little second sowing required.

No damage by insects or weeds.

Live Stock.—Pastures good in spring, but suffered in mid-summer from drought, but were good in autumn again. Stock throve well and were free from disease. Average clip of wool.

HADDINGTONSHIRE (Upper District). *Wheat.*—None grown.

Barley.—33 to 40 bushels; quality of grain and straw good, and better than last year; less straw than last year, owing to drought; 3 bushels sown.

Oats.—34 to 40 bushels; quality of grain and straw good, and better than last year; less straw than last year, owing to drought; 4 bushels sown.

Harvest commenced on 17th August, a month earlier than in 1892.

Hay.—1 ton 10 cwt.; of good quality, but crop deficient, owing to drought. *Meadow-hay*—Less than last year, but of better quality.

Potatoes.—7 tons. Regents, a good few diseased; Magnums and Maincrops free of disease. No new varieties planted.

Turnips.—19 tons 10 cwt.; better quality than last year; crop brairded well; one sowing required.

Crops not injured by insects or weeds.

Live Stock.—Pastures not so good as last year in the early part of the season, but were better in autumn. Stock did very well on them, and were free from disease. Quality of wool about the same as last year.

HADDINGTONSHIRE (Lower District). *Wheat.*—About 5 qr.; quality of grain and straw good, scarcely so much straw as last year; 3½ bushels sown.

Barley.—About 40 bushels; quality rather better than last year; less straw; 2½ bushels sown.

Oats.—40 to 48 bushels; straw shorter than last year, but fine quality; 4 bushels sown.

Harvest began 7th August, or about a fortnight earlier than last year.

Hay.—1½ ton, or half a ton less than last year; fair mixture of ryegrass and clover, and well got.

Potatoes.—About 6 tons, or rather less than last year; a good deal of disease amongst Regents, but none in later varieties.

Turnips.—Better crop than last year; about 25 tons; brairded well; one sowing.

No damage by insects or weeds.

Live Stock.—Pastures about the same as last year; hardly so growthy to begin with, but improved as the season got on. Stock throve well, rather better than last year, and were free from disease. Full average clip; good quality.

BERWICKSHIRE. *Wheat.*—34 bushels; average; 3 bushels sown.

Barley.—40 bushels; above average; 2½ bushels sown.

Oats.—45 bushels; fine quality both of corn and straw; 4½ bushels sown.

Harvest began 10th August, three weeks before the average time.

Hay.—130 stones; poor quality. *Meadow-hay*—Less productive.

Potatoes.—Less yield than last year; 4 tons.

Turnips.—17 tons; quality under average; brairded well; no resowing.

Crops damaged by mildew.

Live Stock.—Pastures not average growth. Stock throve on them and were free from disease. *Clip of wool*—About average.

ROXBURGHSHIRE. *Wheat.*—Small breadth sown; yielded about 27 bushels, quality good; straw, average bulk; quality good; seed sown, about 3 bushels.

Barley.—About 36 bushels; good quality; rather under average bulk of straw; seed sown, generally about 3 bushels.

Oats.—About 38 bushels; generally good quality and remarkably well coloured; straw under average, but fine quality. The best crop that has been for many years on the high-lying or late districts. Seed sown, from 4 to 5 bushels.

Harvest began about three weeks earlier.

Hay.—Generally a want of clovers, and considerably lighter than last year, unless heavily dressed with nitrate; the quality fair; about 1½ ton. *Meadow-hay*—About an average crop, and well got.

Potatoes.—Scarcely such a full crop as last year, with some disease in most sorts but Maincrop Kidney, which kind is quite sound; about 5 tons dressed potatoes.

Turnips.—The crop is nearly a half heavier than that of last year; brairded well; almost no second sowing; about 20 tons.

No damage by insects; very little damage by weeds, a field here and there with a little mustard.

Live Stock.—Average, and good quality. Sheep did very well. Cattle and sheep quite healthy. *Clip of wool*—About average, and quality good.

SELKIRKSHIRE. *Wheat.*—None grown.

Barley.—33 bushels; quality much better than last year; between 3 and 4 bushels sown.

Oats.—36 bushels; quality very much better than last year. Millers say they never had as much meal from the same weight of oats. Straw, very fine quality. On some lands not droughted the yield would be a good deal more than 36 bushels.

Harvest three weeks before the usual time.

Hay.—1 ton 15 cwt.—10 cwt. less than last year; very much superior

in quality; both clover and ryegrass. *Meadow-hay*—Less productive; quality much better.

Potatoes.—Few grown; about 5 tons 10 cwt.; no disease; not aware of any new varieties.

Turnips.—Splendid crop, A1 quality; brairded well; no second sowing; never saw them come so quickly to the hoe; 16 tons; many crops very much more.

No injury by insects or weeds.

Live Stock.—Pastures, quality better than last year. Stock throve well, and were free from disease. *Clip of wool*—Average.

PEEBLESSHIRE. *Wheat.*—None grown.

Barley.—32 bushels, same last year; quality of grain and straw good, and much better than last year.

Oats.—48 bushels, 40 bushels last year; quality of grain and straw very good, and much better than last year; quantity of seed generally sown, 4 bushels.

Harvest began one month before the usual time.

Hay.—Ryegrass or clover, 1½ ton, 2 tons last year; quality good this year. *Meadow-hay*—Less productive.

Potatoes.—9 tons this year, 5 tons last year; very little disease.

Turnips.—20 tons this year, same last year. A portion of the crop was damaged by finger-and-toe this year; it brairded well, only one sowing being required.

No injury by insects or weeds.

Live Stock.—Owing to the drought the pastures for a short time were rather bare, but on the whole they maintained a good growth of fine quality. Stock throve very well, and were free from disease. *Clip of wool*—Quality good; over an average.

DUMFRIESSHIRE (Upper Nithsdale). *Wheat and Barley.*—Not grown.

Oats.—35 bushels; straw average; both of good quality, and secured in prime condition.

Harvest practically over by end of August, and four weeks earlier than in 1892. On several farms situated in the lower end of Nithsdale the crop was practically ruined by an exceptionally severe hailstorm on the 8th of July, thrashing about 6 to 7 bushels.

Hay.—Ryegrass hay a short crop, under 1 ton. This crop suffered greatly for want of rain in the early summer, but the showery weather of July fostered a strong growth of clover, the aftermath being the best seen for years. *Meadow-hay*—An average crop, about 1½ ton, and similar to last year. The drought and intense heat cannot be said to have prejudicially affected the meadows.

Potatoes.—A larger crop than last year, about 8 tons; no disease present, but quality not what could be desired, owing to a second growth subsequent to the rains in July.

Turnips.—Over an average, 20 tons, or about double last year. The seed was sown earlier than in any previous year, and with favourable weather brairded well, no resowing being anywhere necessary. Finger-and-toe was more prevalent and destructive than has been the case for years, and considering that the land was worked in good condition and the season favourable for the plant, this is not easily accounted for.

Very little injury done by insects; weeds easily and completely checked during a dry and sunny June.

Live Stock.—The pastures made an early start, and withstood the severe drought surprisingly. During late summer and autumn the growth was luxuriant and the quality excellent. Stock made most satisfactory pro-

gress, and by autumn were full of condition. Cattle free of disease, but sheep much troubled with foot-rot, while the plague of maggots was something to be remembered. *Wool*—Over the average in quantity, and the quality good.

KIRKCUDBRIGHTSHIRE. *Wheat.*—33 bushels, 2 bushels over last year; quality similar; straw rather shorter; seed about 3 bushels.

Barley.—32 bushels, same as last year; quality better; straw shorter; seed about 4 bushels.

Oats.—33 bushels, slightly under last year; quality much better, generally 42 lb. per bushel; straw good, but 10 per cent to 15 per cent less in quantity; seed, 5 to 5½ bushels.

Harvest ten days earlier than usual.

Hay.—Ryegrass and clover-hay 20 to 25 cwt., or about 30 per cent under last year; quality very good. *Meadow-hay*—Considerably lighter.

Potatoes.—About 6 tons, nearly 1 ton over last year; little disease.

Turnips.—17 tons, or fully 2 tons over last year. Crop brairded extra well, and made rapid progress till end of August, when it suffered much from mildew on lighter soils, otherwise the crop would have been an extra heavy one. No resowing required.

No injury by insects or weeds.

Live Stock.—Pastures were unusually early and good, but in July were more or less burnt on light soils; keep in autumn on clover fig, and seeds extremely good. Stock throve very well, and were free from disease. *Clip of wool*—Fully an average in quantity and quality.

WIGTOWNSHIRE. *Wheat.*—Quantity, 32 bushels; quality of grain and straw superior to last year; quantity of seed used, 3 to 3½ bushels.

Barley.—Quantity, 30 bushels; quality of grain similar to last year, but quantity considerably less, owing to dry scorching weather during the time the ear was forming; straw short; seed, 3¼ bushels.

Oats.—Quantity, 38 bushels; quality of grain and straw superior to last year, but straw very short on dry soils; seed, 5 bushels.

Harvest began from two to three weeks before the usual time.

Hay.—Quantity, 1 ton 8 cwt.; quality superior, but variable, owing to exceptionally dry season. *Meadow-hay*—Less productive.

Potatoes.—Yield, 6 tons. Disease came on about the usual time, but was less severe than usual. No new varieties planted.

Turnips.—Weight, 16 tons; quality in some cases not so good, owing to mildew coming on early. The crop brairded well, and no more than one sowing was required.

In the early stages of growth the crops were attacked by aphides, both green and black, but with the showery weather in August they disappeared without having done any appreciable damage. No injury from weeds.

Live Stock.—Pastures of good average growth and quality, except on light dry soils, which were very much burnt up. Stock throve where there was a fair growth of grass and a good supply of water, which was in limited quantity in many places. *Clip of wool*—Much as usual.

AYRSHIRE. *Wheat.*—A full average crop; not much grown.

Barley.—An average crop; not much grown.

Oats.—A very good crop, the best I have ever seen—I would say 48 bushels.

Harvest was at least two weeks earlier than an average.

Hay.—A full average crop, I would say nearly 2 tons. *Meadow-hay*—full average; showed better than last year.

Potatoes.—A large crop, say 8 tons; very little disease.

Turnips.—A very fine crop, at least 25 tons. The crop brairded well and grew very fast.

No damage by insects; crops very easily kept clear of weeds.

Live Stock.—Pastures, the best grass year I ever remember. Stock did thrive very well. No disease—at least infectious. A very large and good clip.

BUTE. *Wheat.*—None grown.

Barley.—About 36 bushels; grain and straw of good quality, due to good season; seed sown, 4 bushels.

Oats.—About 42 bushels; grain and straw of good quality; seed sown, 5 to 6 bushels.

Harvest commenced on 8th August, about a fortnight earlier than usual.

Hay.—Crop above the average, about 2½ tons. *Meadow-hay*—Not much of this crop in the island, what was of it was extra good.

Potatoes.—Above the average, from 8 to 12 tons. Early varieties diseased to a considerable extent; began about middle of July.

Turnips.—Above the average, from 24 to 35 tons. Crop brairded well; no resowing.

No injury of any moment by insects; not much injury by weeds.

Live Stock.—Pastures above the average. Stock throve well, and were free from disease. "Braxy," however, amongst sheep worse than usual—in some cases almost 40 per cent. *Clip of wool*—Good average.

This island does well with a dry summer, and consequently the crops last season were generally good.

ARRAN. No *wheat* or *barley* grown.

Oats.—38 bushels; quality of both grain and straw better, owing to the fine season—never saw it so good; seed sown, 5 to 6 bushels.

Harvest began two weeks earlier.

Hay.—Scarcely an average, about 1 ton 10 cwt. No *meadow-hay*.

Potatoes.—Better, about 9½ tons. A little disease, commenced about the end of August.

Turnips.—Better than last year, 30 tons per acre; quality good; crop brairded well; mildew a little, or the crop would have been heavier.

No damage by insects or weeds.

Live Stock.—Pastures scarcely average, but quality good. Stock throve very well, and were free from disease. *Clip of wool*—Good, and rather over the average.

LANARKSHIRE (Upper Ward). *Wheat.*—None.

Barley.—Very little grown; over average, say 4 bushels more than last year; quality good.

Oats.—4 bushels more than last year; quality very good, last year being very deficient both in quantity and quality. In some localities straw short and corn scarcely average, owing to severe drought in June and July.

Harvest began about fifteen days before the usual time, or about a month earlier than last year.

Hay.—About 25 cwt.; quality good; less than last year, owing to drought. *Meadow-hay*—Less than last year; quality very good.

Potatoes.—From 8 to 10 tons; little or no disease. Magnum and Maincrop almost free.

Turnips.—25 to 30 tons; quality about same as last year; brairded well.

No material damage by insects, but some cases of finger-and-toe in the turnip crop. In some cases wild mustard very plentiful in the cereal.

Live Stock.—Pastures in very many cases burnt with drought, previous to that quality excellent. Stock throve fairly well, and were free from disease. *Clip of wool*—Average.

LANARKSHIRE (Middle Ward). *Wheat.*—A very good crop, threshing well; straw, 1 ton 10 cwt. per acre; grain, 40 bushels; seed sown, 3 to 3½ bushels.

Barley.—Very little grown in this district.

Oats.—A very good crop; deficient in straw, threshing well, and yielding about 40 bushels; seed sown, 4 to 5 bushels.

Harvest commenced three or four weeks earlier than last season; weather very fine. One of the largest farms on Clydeside had all in in August.

Hay.—A good crop, 1½ to 2 tons; quality very good; weather fine for making. *Meadow-hay*—A good average crop.

Potatoes.—A good crop; on the best cultivated farms, yield from 7 to 9 tons. Regents and Sutton's Abundance mostly planted, and nearly all dug for green sale; the balance of crop mostly all pitted in September, and a good deal of waste from overheating in pits. A good deal of disease.

Turnips.—A very good crop, better than previous year; yield, 16 to 20 tons; brairded well; no resowing, but young plants injured by wood-pigeons.

Crops not injured by insects more than usual. No injury by weeds. Season first-rate for cleaning land.

Live Stock.—Pastures were burned up a good deal with long drought, but did fairly well, and better than last year. Stock throve well, no disease. *Clip of wool*—Average.

LANARKSHIRE (Lower Ward). *Wheat.*—40 bushels; fine quality; 2 tons of straw; 3 to 4 bushels.

Barley.—Little sown in this district.

Oats.—48 bushels; fine quality; 1½ ton of straw; 5 bushels for seed.

Harvest three weeks earlier than last year, eight or ten days before the usual time.

Ryegrass and clover hay.—1½ ton; fine quality, but a little thin and short. *Timothy*—2½ tons, and not so bulky as last year.

Potatoes.—About 8 tons, and a good deal of disease in the earlier sorts. Disease appeared early in August.

Turnips.—This is the crop of the season, about 25 tons of swedes and yellows; a fine braird; once sown.

No injury by insects. A good deal of mustard in oats.

Live Stock.—Pastures above the average, and fine quality. Stock all did well. Little or no disease. Very few sheep in this district.

RENFREWSHIRE (Middle Ward). *Wheat.*—45 bushels; quality of grain above average; seed sown, about 4 bushels.

Barley.—Scarcely any grown.

Oats.—50 bushels; quality above average; seed sown, about 6 bushels.

Harvest generally two weeks earlier, in exceptional cases nearly a month.

Ryegrass hay.—Quantity similar to last year, about 2 tons. *Timothy hay*—About 3 tons. *Meadow-hay*—Similar to last season.

Potatoes.—About 8 tons. In some places the finer varieties were about half destroyed by disease. Magnums and Maincrops, and some other similar kinds, were all but free of disease.

Turnips.—25 tons; quality, as a rule, good—a record season. Crops brairded readily; scarcely any second sowing.

No injury by insects or weeds.

Live Stock.—Pastures fully average. Stock throve very well; exceptionally free from disease. *Clip of wool*—Quality good and above average.

Renfrewshire (Upper Ward). *Wheat.*—About 38 bushels; quality good; straw better than previous crop; seed, 3 bushels.

Barley.—None grown.

Oats.—Good crop, from 32 to 38 bushels; quality above average; straw same as last year; seed, 5 bushels.

Harvest commenced second week of September, three weeks earlier than previous year.

Hay.—Good average crop, 40 cwt., and well got. *Meadow-hay*—About same as last year.

Potatoes.—From 5 to 7 tons; very free from disease except Regents. Same varieties planted as last year.

Turnips.—Best crop of the season, above average, 18 to 20 tons.

No injury with insects. Not much troubled with weeds.

Live Stock.—Good growth of pasture. Cattle and sheep throve well, and were free from disease. *Clip of wool*—Average.

Renfrewshire (Lower Ward). No *wheat* and no *barley* grown. The *oat* crop was an excellent one, both as to grain and straw. The yield varied according to locality and nature of the soil, but was much superior to average years, and may be calculated at 30 to 35 bushels. The grain was heavier in comparison to that of preceding years, and the straw good both in quantity and quality, and of fine colour, as the stackyards at the present time bear testimony to.

Harvest began about a fortnight earlier than usual, and was in every respect a very favourable one. The quantity of seed sown is from 4 to 5 bushels.

Ryegrass-hay did not exceed an average crop, about 1½ ton to the acre, with a good mixture of clover; the quality was excellent, the weather being favourable to securing it, and prices for the early sales were good in consequence of the drought, which visited many parts of England in an almost unprecedented degree. *Meadow-hay*, where irrigation is artificially supplied, was a fairly abundant crop and of fine quality.

Potato crop was above the average, and yielded from 6 to 8 tons an acre. The earlier kinds, as usual, showed disease, but Champions, Magnums, and Bruces showed comparatively little signs of it. Maincrops, a new variety, while of good quality, do not prove themselves to be big croppers in this locality, while in the Lothians they are reported to be turning out the largest produce, and are bringing the best price per ton. Prices were disappointing, and continue to be so.

Turnips proved to be a large crop, and came away well from the first, no second sowing being necessary, and the fly gave no trouble. The yield varied according to circumstances, treatment of the land, &c., and would be from 16 to 25 tons. Swedes were remarkable, and quite excelled the crop of several preceding years.

The ravages of wire-worm, grub, and other insects were overcome by the exceptionally fine season, the plants getting away and gaining growth and strength before these pests could attack them, and weeds were more easily kept in check and destroyed, the season very favourable for working the land. Oats after green crop, however, which is usually an inferior crop in this district, were overrun in some instances by charlock.

Live Stock.—Pastures were luxuriant and the quality good, and stock generally did well. Hill stock had an exceptional season. Ewes were never in better condition, and lambs throve well in consequence. Prices for stock in the early markets were not encouraging, scarcity of keep in

England having a damaging effect; but the later markets—presumably from the prospect of keep in the south improving—gave in some cases a remarkable rise in price, and in some instances cast ewes fetched an unlooked-for increase. The clip was an average, but price of wool continues low.

The rainfall for 1893 was 58.08 inches, about 3 inches less than the two previous years, and the number of dry days 154, which varies very little from the two previous years, only by about one day. It is therefore very curious to note that while 1893 in rainfall and dryness is almost exactly the same as the two former years, which years were by no means favourable to agriculture, 1893 has been one of the most favourable years known during the present century. It rained just when rain was wanted, and when it did not rain the sun and the other climatic conditions which the elements control were favourable for the growth and ripening of plants, the result being that the crops were good, and when the harvest arrived, the weather continuing propitious, they were secured with little labour and in excellent condition.

ARGYLLSHIRE (District of Oban). No *wheat* or *barley* grown.

Oats.—A light crop, 26 bushels. Straw a fourth less than last year; cause, want of rain in month of June.

Harvest began two weeks earlier than usual and finished proportionately.

Hay.—1 ton, about same as last year. *Meadow-hay*—1¼ ton, half ton less than last year.

Potatoes.—6 tons. Disease appeared in middle of August—about a quarter bad.

Turnips.—14 tons; only once sown. Last portion late in brairding; in some cases a second sowing was necessary.

No injury by insects or weeds.

Live Stock.—Pastures of average growth and quality with last year. Stock throve well, and were free from disease. *Clip of wool*—Rather under the average.

ARGYLLSHIRE (District of Kintyre). No *wheat* grown in this district.

Barley.—From 4 to 5 quarters; grain excellent, and from 2 to 3 lb. per bushel heavier than last year; weight from 52 to 56 lb.; straw good; seed sown, from 3½ to 4 bushels.

Oats.—From 5 to 7 quarters on good deep land, and from 4 to 5 on cold high-lying land; both grain and straw excellent. Crop fully an average, and all got in in fine condition.

Harvest fully a fortnight earlier than last year.

Hay.—In general a light crop, but of good quality and well got in; from 1½ to 2 tons, and on some good deep land it might be a little more. *Meadow-hay*—In general light, but of good quality.

Early potatoes—A fair crop, from, say, 5 to 8 tons; slight disease about the month of August. *Late potatoes*—A good crop, and from 4 to 8 tons, according to the quality of the ground.

Turnips.—Above an average; on good dry land they would weigh from 25 to 35 tons, on high-lying cold land much lighter. One sowing.

Very little injury by insects; some grub in a few fields. Very few weeds, the summer being dry.

Live Stock.—Pastures very good in the earlier part of the season, but got bare later owing to the dry weather. Stock throve very well. No disease except the usual braxy in sheep. *Clip of wool*—Very good, and about the average quantity.

ARGYLLSHIRE (Islands of Islay, Jura, and Colonsay). No *wheat* grown.

Barley.—Very little grown.

Oats.—Owing to the very dry spring, where the land was sandy or gravelly the crop was very light; but on good loam, clayey, and mossy land, there was an exceptional good crop both of grain and straw. The quality of both was good, and the grain weighs heavier than usual.

Harvest commenced at least three weeks earlier than usual. On Machin Farm (Islay), oats were cut on the 31st of July, and harvest was general during the first fortnight of August.

The *hay* crop was not quite so bulky as last year, but has weighed well, and is of good quality. The after-crop was exceptionally good. *Meadow-hay* was not so productive as last year, but was better secured.

Potato crop was considerably heavier than last year and the quality finer. There was little disease. Average on fair soil about 6 tons of good potatoes.

Turnips.—Owing to the exceedingly dry weather, the turnips, where the soil was light, died off and had to be resown; on the heavier class of soils, however, they did not require resowing, and have proved a much better crop than last year.

Injury by insects not more than usual. Weeds were much more easily kept down, and crops were comparatively clear of them during the early part of the season; but the potato and turnip crops in many places became overgrown with weeds towards the end of August.

Live Stock.—Pasture was considerably burned in the early part of the season, but revived, and was abundant in quantity and of good quality. Stock throve rather better than last year, and hill stock were early ready for the market. Every year the death-rate from "braxy" is very high, and many sheep die from trembling and *fluke.* On the whole, the death-rate appears to have been somewhat lower than usual, although many farmers suffered severely. *Clip of wool*—About an average both in quantity and quality.

ARGYLLSHIRE (District of Inverary). No *wheat* or *barley* grown.

Oats.—A good crop; scarcely so heavy in straw, but heavy grain, from 24 to 30 bushels, and well secured.

Harvest quite a fortnight earlier than 1892, and soon got over.

Hay.—Ryegrass a fair good crop; clover for this district unusually good on account of the dry season; average of both crops about 24 to 26 cwt. *Meadow-hay*—Particularly in damp ground, very good; all well saved.

Potatoes.—An unusually plentiful crop, about 7 tons; scarcely any disease, but the quality, strange to say, was not good. Various newer kinds tried—the Bruce probably yielded best.

Turnips.—A very heavy sound crop, from 20 to 30 tons; scarcely any resowing required. By some mistake the weight was given last year as cwt. instead of tons.

No damage by insects observable in this district. Damage by weeds less than usual, owing to the fine dry warm weather.

Live Stock.—Pastures, probably the grass was not so long, but more nutritious, and stock did well. No disease in this district. *Clip of wool*—Quite up to average.

DUMBARTONSHIRE. *Wheat.*—28 to 30 bushels grain, and about 25 cwt. of straw; quality good in both, but quantity of straw reduced by dry weather; 2½ to 3 bushels sown.

Barley.—Very little grown, about 30 bushels; straw about 20 to 25 cwt.; quality of both good; 3½ bushels sown.

Oats.—From 40 to 48 bushels; 25 to 30 cwt. of straw; quality of both good.

Date of *harvest* varied according to the district; on early good land about ten days earlier, and on light hill-land about three weeks earlier than average.

Hay.—28 to 32 cwt.; quality fine and well got. In many instances a luxuriant second crop, far above average. *Meadow-hay*—Better than last year.

Potatoes.—6 to 8 tons. In some districts disease appeared about middle of August, and 30 to 50 per cent lost; other districts exempt; best land suffered most. No newer variety than Maincrop, a good disease-resister, fine quality, but not specially prolific.

Turnips.—16 to 20 tons; quality good; quantity less than weight of last season in some districts, owing to dry weather; brairded well; no second sowing.

No injury by insects or weeds.

Live Stock.—Pastures abundant and of fine quality. Stock throve very well, especially sheep, and were free from disease, except braxy, which was more prevalent than last year. *Clip of wool*—Quality good, fully average.

STIRLINGSHIRE (Western District). *Wheat.*—None sown.

Barley.—About 34 bushels; good crop, of fine quality.

Oats.—About 34 bushels, with an average crop of straw, both grain and straw being of fine quality; seed, about 4 bushels.

Harvest two weeks earlier than last year.

Hay.—Better than last year, 28 to 34 cwt.; well mixed with clover, and mostly secured in good condition. *Meadow-hay*—Quite as heavy as last year, and of fine quality.

Potatoes.—8 to 10 tons, of superior quality. Unfortunately disease, which is estimated on an average to have been somewhere about 5 per cent, set in.

Turnips.—Good crop and fine quality; 25 to 40 tons. Brairded well and kept growing; no second sowing.

Very few insects; no damage done by them. Few weeds, season being favourable for cleaning land.

Live Stock.—Pastures good throughout the season. Stock throve very well. Cattle and sheep pretty free from disease. *Clip of wool*—Superior to the two former years.

STIRLINGSHIRE (Eastern District). *Wheat.*—42 bushels; quality of both wheat and straw better than last year, also quantity about same; 3 bushels seed.

Barley.—35 bushels yield; grain very good and malting extremely well; straw just medium quantity on early land, but much bulkier on later districts; 3¼ bushels of seed.

Oats.—34 bushels; largest yield of grain and best quality for some years back; big bulk of straw; 4 bushels of seed.

Very early *harvest*, more especially in later districts, which would be about four weeks earlier.

Hay.—First crop rather light—Kerse, 35 cwt.; Dryfield, 30 cwt. Second crop very good and well secured. *Meadow-hay*—A moderate crop, pretty well secured.

Potatoes.—10 tons—more than last year; early potatoes more diseased than late varieties.

Turnips.—Swedes, 19 tons; yellows, 16 tons. Quality and quantity much better than last year; no second sowing.

No damage by insects. No damage by weeds on well-cultivated land.

Live Stock.—Pastures very good, much better than last year. Stock throve very well, and were free from disease. The best *clip of wool*, on account of favourable spring, that has been for the last year or two.

Clackmannanshire. *Wheat.*—Dryfield, none sown; Carse, about 40 bushels. Grain and straw excellent quality; grain above an average by at least 8 bushels; seed used, about 3 bushels.

Barley.—Carse, a poor crop, average about 30 bushels; grain fine quality, below an average by at least 8 bushels; seed used, about 3 bushels. Dryfield, little or none sown.

Oats.—Carse, average about 50 bushels, 10 bushels above an average; straw and grain excellent quality; straw short; seed used, 4½ bushels. Dryfield, 28 to 38 bushels; quality of both grain and straw excellent; straw not so bulky as last year; seed used, 4 bushels.

Harvest.—Carse was at least two weeks earlier; Dryfield fully three weeks earlier.

Hay.—Carse, varied from 1 ton 5 cwt. to 2 tons; second crop where top-dressed equal to the first. Dryfield, about 1 ton 10 cwt.; second crop pastured. No *meadow-hay* grown. *Timothy hay* grown in Carse, an average crop of about 2 tons.

Potatoes.—Carse, very little grown; Dryfield, about 8 tons, nearly double the quantity of last year. Very little disease on some farms, on others about one-third of the earlies; no disease in the late varieties; disease commenced about 1st September. One farmer has raised a new kind from the Victorias, named after himself (Bletoch's Prolific), which were a splendid crop with no disease.

Turnips.—Carse, a very good crop; swedes, about 25 tons; yellows, 20 tons. Dryfield swedes, 23 tons; yellows, 20 tons. Quality on the whole very good. There was a very fine braird, and no resowing.

No greater damage than usual by insects, but every year the damage done by birds before harvest is increasing and getting serious. No damage done by weeds.

Live Stock.—Grass was not of average growth, but of good feeding quality. Stock throve fairly well. Cattle and sheep were free from disease. *Clip of wool*—Fair quality, and of average quantity.

Fifeshire (Eastern District). *Wheat.*—32 bushels; straw, 1½ ton; quality of grain better than last year; straw much the same as last year; seed, 3 bushels.

Barley.—30 bushels; straw, 1¼ ton; quality of grain and straw better than last year; seed, 3 bushels.

Oats.—38 bushels; straw, 1½ ton; quality of grain and straw same as last year; seed, 4 bushels.

Harvest about a fortnight before the usual time.

Hay.—1½ ton; crop less than last year; quality good. *Meadow-hay*—1¼ ton; very little grown in the district.

Potatoes.—4½ tons; crop less than last year; very little disease. Bruces are chiefly grown; about one-fourth Maincrop Kidneys, which are small croppers, and poor quality this season, and almost unsaleable. No new varieties.

Turnips.—Yellows, 14 tons; swedes, 16 tons. Crop better than last year; quality good; brairded well; no resowing.

No injury by insects or weeds.

Live Stock.—Pastures, average growth and quality. Stock throve much better than last year. Cattle and sheep have been free from disease. *Clip of wool*—An average one.

Fifeshire (Middle District). *Wheat.*—The field would be about 26 bushels, and there would be about 22 cwt. of straw. The quality both of grain and straw very good. Wheat generally was thin on the ground, but the quality of grain and straw superior to the yield of the previous. 3 to 3½ bushels of seed, almost always sown broadcast.

Barley.—Barley has not yielded well; the average yield will not be above 29 bushels, and very few fields will thrash 32 bushels. The quality of grain is excellent both as to weight per bushel and colour. Straw will not turn out more than 18 cwt. The seed generally sown broadcast, about 3 bushels. In very few seasons is the quality of this grain as good as the crop of 1893.

Oats.—The crop of oats was a small one. The yield of grain will not be above 36 bushels; weight of straw about 1 ton. The quality of grain very good, and the straw excellent—yellow and sweet. All the crops were secured in first-rate order.

Cutting was begun in this district about 15th August, and was general by 21st August; so that if harvest be begun on an average year by 1st September, then last harvest was begun a fortnight before the usual time.

The *hay* crop was generally, owing to the great drought, a very light one, more especially where the young grasses had been for any time depastured in the spring. The weight of the crop will not exceed $1\frac{1}{4}$ ton; the quality cannot be excelled. There was a fair proportion of clover. Very little *meadow-hay* made in the district.

Potatoes.—The yield of this crop was superior to that of last year. There was no loss by frost. The crop was got up in a very clean state, free altogether from earth; but generally there was a large proportion of small potatoes. The yield would be about $5\frac{1}{2}$ tons. Regents and early sorts were diseased to some extent; Bruces, Maincrops, and Magnums, &c., free. No new varieties to any extent were planted.

The *turnip* crop, both as to quantity and quality, was superior to the crop of last year. Swedes are a very large crop, 20 tons; yellows, more especially those that did not braird until after the rain of 21st June, are a very large crop, and quality excellent. Those that brairded before that time were checked in their growth, and are considerably diseased and not so heavy; the average will be 16 tons.

The crops, as a rule, are very little injured by weeds in this district; but last year, owing to the heat and drought, growth was considerably checked in the early part of the season, and there were in many fields pretty large patches of wild mustard, &c.

Live Stock.—Pastures, there was scarcely the same amount of growth as in the summer of 1892; but the quality of the grass was much better, as both cattle and sheep came off the grass in fine condition—in a much better state than during the previous year, and were altogether free of disease during the summer; but young sheep have been dying in considerable numbers while feeding on the turnip crop. The *clip of wool* was of average quality and quantity.

FIFESHIRE (Western District). *Wheat.*—34 bushels; quality of both straw and grain better than last year, indeed one of the best crops we have had for a number of years; $1\frac{1}{2}$ ton straw; 3 bushels of seed.

Barley.—40 bushels; a full average crop both in quantity and quality, the quality being superior to last year; 1 ton straw; 3 bushels seed.

Oats.—54 bushels; one of the finest crops for many years, much of the second-class land yielding beautiful quality of grain; straw an average quantity; 1 ton straw; 4 bushels seed.

In early districts *harvest* commenced about the 15th September, nearly two weeks earlier than average years.

Hay.—$1\frac{1}{2}$ ton; superior quality. Crop did not bulk more than last year.

Potatoes.—A good average crop; fine quality; very little disease, and that chiefly in the old early sorts. Several new varieties planted with good results, especially on lighter soils; Maincrop Kidney sorts cropped best on good heavy soils.

Turnips.—Very big crop all over. Yellows grew very fast, which may have been against their solidity; swedes an exceedingly fine crop. Braird good; no resowing. Crop nearly all secured early in grand condition.

No damage by insects. No more weeds than in an ordinary year.

Live Stock.—Pastures quite an average. Stock did very well; no disease reported. *Clip of wool*—A full average.

PERTHSHIRE (South-West District). *Wheat.*—Rather above an average crop of both grain and straw; 36 to 40 bushels; about 63 lb.; seed, 4 bushels.

Barley.—A good average crop of grain and straw; about 36 bushels; weight, 56 to 58 lb.; seed, 3½ bushels.

Oats.—About one-third below average in grain and one-half below average in straw; 36 bushels; weight, 42 to 46 lb.; seed, 4 to 5 bushels.

Harvest.—A fortnight earlier than usual, and very speedily and cheaply finished, owing to favourable weather and the assistance of the self-binder.

Hay.—Fully one-third under average; barely 1 ton; quality fair. *Meadow-hay*—Average crop; quality pretty good.

Potatoes.—Considerably above an average crop, but one-third diseased; about 9 tons; price very low, say 30s. per ton.

Turnips.—Above average crop; 20 to 24 tons; quality extra good; no difficulty in securing a braird with first sowing.

Not damaged by insects. Weeds were very easily kept down owing to the fine season.

Live Stock.—Pastures grazed well. Stock improved very satisfactorily. Cattle and sheep free from disease. A good average clip in quantity and quality; price a shade under last year's.

PERTHSHIRE (District of Coupar-Angus). The average yield of *wheat* in this district will be from 24 to 32 bushels, and the quality of both grain and straw much superior to that of the previous year, owing to the fine dry warm summer. The yield of straw, however, will be under the average of previous years. Quantity of seed generally sown from 2½ to 3½ bushels.

Barley much above the average of years as to quantity and quality of both grain and straw; average yield of grain from 40 to 50 bushels; seed generally sown from 2 to 3½ bushels.

Oats.—The yield of oats will be under the average of the previous year both in grain and straw, but the quality of both much superior; average yield of grain about 40 bushels.

Harvest began about a month earlier than in 1892, and fully a fortnight earlier than the average of years.

Clover-hay.—Under an average as to quantity, but quality good, and crop generally well secured; average yield from 1 to 1½ ton, under that of the previous year by at least half a ton. No *meadow-hay* grown in this district.

Potatoes.—Yield under the average of the previous year, being generally small in size, but quality much superior. In some places there was a good deal of disease amongst the Regents and Sutton's Abundance and other early sorts, but little or no disease amongst the Magnums and Maincrops and other late sorts. Average weight about 6 tons.

Turnips.—Swedes a good average crop, from 20 to 25 tons; yellows not so good, from 15 to 20 tons. Those sown early on light dry soils were considerably affected with mildew, and in some places a good deal of finger-and-toe existed; those sown early before the dry weather set in brairded well, but much of the later sowings did not braird till the rain came.

Little or no damage to crops by insects. Very little damage by weeds—less than usual, wild mustard being the prevailing weed in this district amongst spring-sown crops.

Live Stock.—The pastures were not so good this year, owing to the long continuance of dry weather during the early part of the season; stock, notwithstanding, throve well on the grass, and both cattle and sheep have been particularly free from disease. The *clip of wool* an average one both as to weight and quality.

PERTHSHIRE (District of Strathearn). *Wheat.*—Little grown; average crop, 30 to 40 bushels; 3 bushels sown.

Barley.—A full average crop, 30 to 40 bushels; fairly well coloured; 4 bushels sown.

Oats.—A fairly good crop, 40 to 45 bushels; 4 to 5 bushels sown; straw in many places short where grain early sown; grain well filled and bright in colour.

Harvest fully a fortnight earlier than last year, and on the whole a good one.

Hay crop very much under average in consequence of the excessive drought during May and June; 1 to 1½ ton; secured in good condition. Clover in some cases deficient. In many places a good second crop was secured. *Meadow-hay* was under an average crop, but well secured.

Potato crop fully equal to last year in quantity, 6 to 8 tons. Regents a good deal diseased, but other varieties not so much so.

Turnips.—Above average crop, 20 to 25 tons. Swedes, on account of the dry weather in May and June, remained long stationary, and thinning was long in beginning. Brairded well, not much second sowing required; but grub and wire-worm in a few cases was destructive to a small extent.

No injury done to crops by insects or weeds.

Live Stock.—The pastures were in many cases much affected by the excessive drought in the early part of the season, and their growth consequently deficient, but the quality good. Stock throve exceedingly well, and where grass was not burned up by the drought and they were caked, were early fattened and ready for market. Both cattle and sheep have kept quite free of disease. The *clip of wool* was of good quality and fully an average.

PERTHSHIRE (Highland District). *Wheat.*—None grown.

Barley.—Short in straw, light land burnt altogether; grain good and well harvested; from 28 to 30 bushels; weight, 54 lb.; seed, 3½ bushels sown.

Oats.—Short in straw, and the second growth on thin land, after the rain came, spoiling the quality of the grain after green crop land worse than lea; quantity, 40 bushels, and weight 42 lb. per bushel, and harvested well; 5 bushels sown.

Harvest two or three weeks earlier.

Hay.—Bad crop; 12 cwt.; burnt and short. Ryegrass not good, owing to dryness of season. *Meadow-hay*—On high boggy ground more, and on low land less; on gravelly soil not worth cutting.

Potatoes.—A good crop; good quality; no new varieties; some disease; about 5 tons.

Turnips.—Quality various; 14 tons; more diseased with finger-and-toe; brairded well.

No damage by insects or weeds.

Live Stock.—Pastures good; quantity small, but quality excellent. Stock throve fairly well; in good condition, but suffered from want of water; free from disease. *Clip of wool*—Good, quite up to average weight, but price low.

PERTHSHIRE (District of Dunkeld and Stormont). *Wheat.*—Not much grown.

Barley.—Short crop of straw; grain good, from 54 to 56 lb. per bushel; 4 bushels sown; yield, 32 bushels.

Oats.—Short crop of straw; some fields almost a failure owing to drought; quality of grain very good; weight, 42 to 44 lb.; yield 36 bushels; 5 bushels sown.

Harvest very early; commenced about the second week of August, was finished by second week of September, one month before usual time.

Hay.—Poor crop of hay, but well secured; yield about 1 ton. No *meadow-hay* in this locality.

Potatoes.—Good crop; about 6 tons; not much disease; no new variety.

Turnips.—A fair crop; from 18 to 20 tons; quality good, except patches of finger-and-toe; crop brairded well, but during August and September considerable mildew, owing to severe drought.

No damage by insects. Weeds easily checked owing to drought.

Live Stock.—Pastures were short for want of rain. Stock throve very well where not overstocked, and were free from disease except a case or two of anthrax. An average clip both in quantity and quality.

FORFARSHIRE. *Wheat.*—40 bushels; good quality; 1½ ton straw of good quality.

Barley.—40 bushels of first-rate quality; 1½ ton straw, also of good quality.

Oats.—48 bushels or so of first-rate quality; 1¾ ton of straw. My information is very conflicting, as the rains of summer were very partial. Land lying towards the Sidlaw Hills and pretty well east being more favoured with heavy showers, while land lying towards the Grampian Hills never got a drop, so some of the farmers on the north side of the vale had a poor yield.

Harvest began about a fortnight before the usual time.

Hay would be from 15 cwt. to 2 tons, and very much short of clover, owing to the very heavy crop of barley in 1892, and the want of moisture during last season. Scarcely any *meadow-hay* made in this neighbourhood.

Potatoes.—About 8 tons, with less disease than last year; not many new varieties, if any.

Turnips would yield from 16 to 36 tons; I think 25 tons would be about an average. Early turnips brairded well, but late-sown ones came up very irregular; but not more, as a rule, than one sowing was required.

No injury by insects or weeds.

Live Stock.—The pastures were really good with the exception of about three weeks in or about the middle of summer, when the heat was at its greatest. We had an uncommon early bite, and it held out well late in the autumn. Stock did very well where water was plentiful, and, as a rule, were free from disease. *Clip of wool*—About an average.

ABERDEENSHIRE (District of Buchan). *Wheat.*—Not grown.

Barley.—Barley and bere fair crop, but not particularly good as to colour or quality; weight from 53 to 55 lb.; average, 36 bushels; from 3 to 5 bushels sown.

Oats.—A different result from last year, being superior as to quality, especially straw, which will be very scarce owing to the readiness with which it is eaten up by stock. The crop was got into the stackyard in splendid order. Weight, 40 to 45 lb.; sown from 5 to 6 bushels.

Harvest commenced last year about 20th September, this year about 22d August, and finished about 19th September.

The *hay* crop was a fair average both as to quality and quantity, and was got well secured; well mixed with clover; the yield would be about 30 to 34 cwt. Little *meadow-hay* in the district.

Potatoes.—The crop generally had a luxuriant appearance as to shaws, but in some cases did not prove so well as to tubers, although in general the potatoes turned out fairly well, and were pretty free from disease.

Turnips.—The crop is a superior one, both yellows and swedes, and has been free from disease, and kept well as to soundness; will be far more plentiful than straw. Weight of swedes, from 22 to 30 tons; yellows, 20 to 27. The braird came away evenly.

No injury done by insects. Weeds were somewhat difficult to be kept down towards the latter part of the season.

Live Stock.—The pastures were good during the season, but cattle and other stock did not make the progress on the grass they should have done, owing to the very bad straw they had during the previous winter. Cattle and sheep have been free from infectious diseases. The *clip of wool* was about the average.

ABERDEENSHIRE (District of Formartine). No *wheat* grown in this district.

The *harvest* all over proved to be one of the earliest and most successful of recent years. Barley and bere was an abundant crop, with as much straw as last year. The quality of the grain was far better than last year, and the weight per bushel far above that of last year—36 to 40 bushels, and the weight 56 to 58 lb. per bushel; 4 bushels barley and 3 bushels bere sown.

Oats proved a fine crop, yielding on many farms 40 to 45 bushels; weight per bushel, 42 to 43 lb. Fodder was more plentiful on some farms than last year, the straw being sweet and nutritious, and almost as acceptable to cattle as hay. Quantity sown per acre, 5 to 6 bushels.

The *harvest* was fully a month earlier than last year—it was general by the 25th August.

The *hay* crop not so heavy as last year, about 1 ton 6 cwt. This crop was well secured and got into ricks in good order. No *meadow-hay*.

Potatoes.—The crop not so heavy as last year; was of good quality, with a much larger percentage of small.

Turnips.—The swedish turnips are a good crop; yellows not so heavy as last year, owing to the drought in the early part of the season. On dry early farms the yellow turnips are a light crop, but of remarkably good feeding quality. Swedes about 18 to 25 tons; yellow turnips about 13 to 15 tons.

Not much damage by insects. In some districts the oats after lea were much thinned by the grub-worm and did not ripen equal. The land in this district is generally kept clean, so that there are scarcely any weeds.

Live Stock.—Pastures were an average, and owing to the dry season, of much better quality. The stock throve well on the pastures; owing to the dry and warm season, they had always a dry bed. Cattle and sheep have been free of disease. The *clip of wool* was a good average.

ABERDEENSHIRE (District of Garioch). No *wheat* grown.

The crops of *barley* generally good, and yield satisfactory, 44 bushels being about an average, or 8 bushels above the crop of last year, which was harvested before the weather broke. The grain is also superior, but dark coloured, 56 lb. per bushel being a common weight. Fully 4 bushels is allowed for seed.

After lea the crop of *oats* and straw remarkably good; but after turnips, in the majority of cases, thin on the ground, and straw short, which will be much felt before the close of the season. The yield would be all round

42 bushels, weighing 42 lb. A comparison with the crop of last year, which was so much damaged, can scarcely be made.

Barley harvest was commenced between 17th and 20th of August, and oats about the 24th, or a week earlier than an average of seasons.

The season during the maturing of the *hay* crop was very dry, which decreased the weight; the quality, however, was good, with a well-balanced mixture of ryegrass and clovers; but a weight of only 1¼ to 1½ ton can be written, showing a decrease of nearly one-half ton from last year. No *meadow-hay.*

The *potato* crop is similar to previous year, yielding a weight of 6 tons. Amongst the early varieties there is a deal of disease, but even the Champion variety is giving way. The Bruces appear to be the soundest crop this year. No new varieties of any consequence have been introduced.

The *turnip* crop has shown good results, which is confirmed by the inspection of Garioch Turnip-growing Association. Up to the 1st of February no mishap through frost has occurred to the crop as was last year; a deficiency of straw will, however, be against the utilisation of the crop with advantage.

No insects of any kind retarded the growth of either cereals or roots, and the land in this district is kept free of weeds.

Live Stock.—The pastures afforded a good bite throughout the season, and the weather being favourable, stock made ample progress, and both cattle and sheep have been free from disease. The quantity and quality of the *clip of wool* similar to last and previous years.

Aberdeenshire (District of Strathbogie). There is no *wheat* grown in Strathbogie, and now very little of either *barley* or *bere*, on account of the general lateness of the district. Farmers have indeed been giving up the growth of these cereals of late years, as they have been finding rather better results from oats, when the extra value of the straw for fodder is taken into consideration. Generally the samples of barley and bere of crop 1893 were superior, and the yield probably a little above the average, and may be stated at about 44 bushels, and the weight from 55 lb. to 58 lb. per bushel. On account of the excessive dryness of the early part of the season, the straw has been deficient—probably one-third shorter than is generally the case.

Oats have likewise been short of straw, which will be remarkably scarce before the season for inside keep of stock be finished. The quality of the grain has been quite superior, in cases where the seed was purchased, and this was generally the case, as the crop of 1892 was practically of little value in this district. In the few exceptional cases where seed of home growth was used, the crop was about ten days later, perhaps a little ranker in straw, but on the threshing-floor it has proved unsatisfactory, being deficient in the quantity and quality of grain, which would weigh from 3 to 4 lb. less per bushel than the produce of the imported seed.

The *harvest* was unusually early, indeed the earliest since 1868, the ever memorable year of the short crop. Work with the reapers began about the last week in August, and may be stated to be about a fortnight earlier than an average season.

The *hay* crop was unusually light, which was doubtless caused by the abnormally warm and dry summer. As a rule, it may be stated as little more than half an ordinary crop. The first part of the hay season was good, and quite suitable for the proper making of good hay; but towards the middle of the season the weather broke, and great difficulty was experienced in curing and carrying to the stackyard, and not a little was spoiled and in a manner rendered useless for horses' food.

The *potato* crop has been the best that has been grown for a number of

years, the quantity per acre being much above the average, and the quality excellent. Perhaps the yield may be safely stated at from 8 to 9 tons. Regarding new varieties, it may be mentioned that the only kind that was tried was Maincrops, and it is satisfactory to be able to record that they have done well. The variety has proved to be about two weeks earlier than the favourite Champion, and the quality quite as good. If farther and more extensive trials prove satisfactory, Maincrops will doubtless become a great favourite as a field potato.

The *turnip* crop has generally been bulky, and of splendid feeding quality. A fair estimate for yellows would be 24 tons, and swedes may be stated at 30 tons. The plants came beautifully to the hoe, and there has not been any disease.

Stock throve well on the pastures; but, on the whole, grass suffered a good deal from the drought, and many farmers were very scarce and experienced no little difficulty in getting through the season. Cattle and sheep have been unusually free of disease during the whole season. The *clip of wool* was under average.

BANFFSHIRE (Lower District). No *wheat.*

Barley.—Good crop; quantity, 40 bushels, about same as last year's yield; quality of grain good; straw, good quality, but did not bulk well in stackyard; seed sown, 4 bushels.

Oats.—Fine turn out of grain; about 40 bushels, or 16 bushels over last season; straw, extra quality, but, like barley, did not bulk well; seed sown, from 5 to 6 bushels.

Harvest was a month earlier than last year, about the middle of August; duration from 4 to 5 weeks.

Hay averaged from 1½ to 2 tons; quality good. *Meadow-hay*—About the same as last year; very little in this district.

Potatoes below last year; 4 tons; very little disease.

Turnips.—A better crop this year; about 20 tons; brairded well; little or no second sowing.

Turnip-tops seemed to fade early all over, and a good few farmers ascribe the cause of this to an insect found near the neck of the bulb. Not much damage by weeds.

Live Stock.—Pastures fell off a little at first from drought, but they stood out extra well in the end of season. They were as good in October as in the month of August. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—About the same as last year.

BANFFSHIRE AND MORAYSHIRE (Upper District). No *wheat* grown in this district.

Barley.—The quantity and quality of grain and straw were much superior to last year. This year the crop would average about 38 bushels, weighing 56 lb. per bushel; last year about 30 bushels, weight 48 lb. Quantity of seed is generally 4 bushels.

Oats.—The quantity and quality much superior to last year; an average of about 42 bushels, and weight 42 lb. Last year about 30 bushels; weight 37 to 40 lb. The straw shorter than last year, but fine quality.

The *harvest* this year was general about 12th August, which is about 5 weeks earlier than usual.

Hay crop rather short; not very well harvested. No *meadow-hay.*

Potatoes.—Few grown in this district for sale. They were a good crop, and not much disease. No particular varieties planted.

Turnips.—The crop is heavier than last year; on some dry fields it suffered from the extreme drought; braird very good; no second sowing; weight about 18 tons.

No injury by insects; not more than usual by weeds.

Live Stock.—Pastures very good at first and early, but the great heat of July and August burned them up in many places. Stock throve very well, and were quite free from disease. *Clip of wool*—Over an average.

MORAYSHIRE (Lower Districts). *Wheat* is not threshed in Moray, as a rule, until the season is well advanced—until spring and early summer. Some portions of it, however, are threshed earlier, chiefly at the end of harvest, in order to get the straw for thatch and the grain for seed. The crop was a fairly good one, in some cases excellent. The yield would vary from 32 to 56 bushels, averaging perhaps 40 bushels. The grain is fairly good in body and colour, but not up to what might have been expected in so fine a season. Quantity of seed sown is from 3 to 4 bushels. The area of wheat sown is rapidly diminishing.

Barley is the principal grain crop of the lower districts of Moray. Soil and climate suit it. And Elgin grain market has, especially in recent years, become one of the best barley markets in Scotland—often it is the best. Much of the barley grown in the whole of the counties north of the Grampians is now sold in it. One reason of this is the convenience of Elgin as a centre; another is its nearness to the Speyside distilleries, which now buy and use a large proportion of the barley of the North. The crop of 1893 looked well on the ground, except on some spots of very light land, on which it was burnt up, and stunted in growth by the severe drought of June. Much of it is not up to expectations in yield, and the straw soft. It has no standing-up power either in folds or stalls. Stack-yards are going down in bulk very fast, and it is evident that straw will be very scarce and dear. Already, at Christmas, it is worth 8d. a stone of 22 lb. Bright and fine as the season was, barley is dark in colour and not so fine in the skin as it often is. Scarcely any of it has been up to brewers' quality. It has good body and weighs well, but it is very doubtful if the average yield per acre would much exceed 36 bushels; it would be under 40 bushels. Weight is often 56 to 58 lb. per bushel. Quantity of seed, 3 to 4 bushels.

Oats.—Oats are threshing exceptionally well, and are very fine in quality, nice in colour and finish, and up to 43 to 46 lb. per bushel. Yield would vary from 32 up to 60 bushels, averaging perhaps 48 to 50 bushels. Seed used, about 4 bushels an acre.

Harvest was early, beginning early in August, about the second week of the month. It was very near a month earlier than in 1892, and about a fortnight earlier than usual; and in the higher districts it began nearly as soon as on the seaside.

Hay was thin on the ground, and rather wanting in clover, which was stunted by drought in June and never came to anything like full development either in stalk, leaf, or flower. Rye and other grasses, however, were strong, and in some cases of great length. The yield per acre would not average over 28 cwt.

Potato crop looked beautiful all the season, but some disease appeared towards ripening; stronger varieties, however, were free of it. The yield would be above average, perhaps 7 tons.

Turnips.—In various turnip experiments weights have varied from 18 tons to 35 tons. Taking all the lower district over, the average weight might be about 25 tons. Canker spoiled many fields considerably, but on the whole the crop was big. The fine season secured very regular brairding. There was very little second sowing.

No injury by insects. No injury by weeds except where the drought of June stopped the growth of grain crops and allowed weeds to come up.

Live Stock.—Pastures during the season were of average growth and quality with last year. Though burnt up for some weeks in June, they

recovered afterwards, and were unusually rich in the end of the season. Stock throve on them, and were free from disease. *Clip of wool*—About same as usual.

NAIRNSHIRE. No *wheat* grown.

Barley.—36 bushels; quality good; a little darkened by rain in harvest; about equal with last.

Oats.—42 bushels; good, rather over last year.

Harvest began fifteen days earlier.

Hay.—quality good; rather less than last year. No *meadow-hay*.

Potatoes.—Yield about equal; very little disease.

Turnips.—16 to 20 tons; a good deal finger-and-toe; brairded well; no second sowing.

No injury by insects or weeds.

Live Stock.—Pastures during the season were of average growth and quality with last year. Stock throve well, and were free from disease.

INVERNESS-SHIRE (District of Inverness). *Wheat*.—Owing to the unremunerative prices obtainable for wheat very little has been sown in the Inverness district for several years, and in 1894 there was none.

Barley.—Average crop, while the quality was excellent; and there was no damaged grain, notwithstanding the somewhat protracted harvest. The average yield on best land about 40 bushels, and on light and poor soils 25 bushels. Quantity sown, from 3 to 5 bushels, according to soil.

Oats.—The oat crop was a very fair one, but in many light lands the straw was deficient, and the stockyards have on many farms shown early signs of decay, and straw is very scarce and dear; average yield from 20 to 40 bushels on light and good land respectively; from 3 to 6 bushels of seed are sown.

Harvest operations began two weeks earlier than usual, but the weather was often unsettled, and it was occasionally interrupted with rain, but no damage was done to cereals by sprouting.

Hay.—On well-cultivated land 2 tons of excellent hay were reaped; there was an abundance of clover and ryegrass; both quantity and quality exceeded last year's return.

Potatoes.—The yield of potatoes was under last year's crop, but the quality was excellent; no disease; average return about from 5 to 6 tons. The new varieties were Maincrop and some of Faiday's Prolific productions.

Turnips came away fairly well, there being no resowing; but owing to a period of alternate wet and dry weather a kind of dry rotten finger, resembling finger-and-toe, was more prevalent than usual. Yield from 15 to 26 tons.

Crops were not injured by insects. The usual couch-grass and wild mustard prevailed, but not more than in former years.

Live Stock.—Pasture-grass was fairly good throughout the season. Stock throve well. No disease of any kind has appeared in the North of Scotland during 1893. The *wool clip* was about an average of former years.

INVERNESS-SHIRE (Skye). *Wheat*.—None grown.

Barley.—None grown.

Oats.—Well over an average crop; 34 to 36 bushels; crop damaged by rain after cutting; 6 bushels generally sown.

Harvest began at least a week earlier than usual.

Hay.—An average crop, secured in good condition. *Meadow-hay*—Better than an average crop; quality suffered from continued wet weather after cutting.

Potatoes.—An average crop of good quality; 6 tons; no disease; no new varieties planted.

Turnips.—18 to 20 tons; a better crop than last year; crop throve well; no second sowing required.

No injury by insects or weeds.

Live Stock.—Pastures during the season of average growth and quality with last year. Stock throve well on them, and were free from disease. *Clip of wool*—Good; over the average as to quantity.

INVERNESS-SHIRE (Lochaber). *Wheat.*—Not grown.

Barley.—Very little grown.

Oats.—32 bushels; straw short; quality of grain good; 6 bushels seed sown.

Harvest began three weeks before the usual time.

Hay.—One ton; quality good. *Meadow-hay*—More productive, and much more easily saved.

Potatoes.—5½ tons. There was a little disease, which commenced in August. No new varieties planted.

Turnips.—8 tons; quality bad, mostly gone with finger-and-toe; crop brairded well; only one sowing required.

No damage to crops by insects; oats a good deal damaged by "yarr."

Live Stock.—Pastures rather below the average growth and quality. Stock did fairly well. Cattle and sheep were free from disease. A good average clip.

ROSS-SHIRE (Western District). *Wheat.*—None sown.

Barley.—Little or none sown.

Oats.—6 bushels sown; average crop, 3½ quarters; quality fair.

Harvest three weeks later than usual.

Hay.—Quantity 15 cwts.; quality fair. *Meadow-hay*—Less productive.

Potatoes.—Yield better than last year about 8 tons; little or no disease; no new varieties planted.

Turnips.—Weight, 10 tons; quality not good; brairded well; only one sowing required.

Damage by grub greater than usual; no damage by weeds.

Live Stock.—Pastures during the season of average growth and quality with last year. Stock throve well, and were free from disease. *Clip of wool*—Quality good, and above the average.

ROSS-SHIRE (District of Dingwall and Munlochy). *Wheat.*—Average, say, 36 bushels; quantity quite average; seed, 3 to 4 bushels; straw, quality fine; quantity fair.

Barley.—Quantity below average, 34 to 36 bushels; quality rather over average; straw short of average, owing to severe drought.

Oats.—Quantity also below average, say 30 bushels; quality over average; quantity of straw 25 per cent below average; quality of straw fine.

Harvest began early in August, say fourteen days earlier; weather very broken at first, but still good over all.

Hay.—Below average in quantity; quality good; clovers were rather below usual; quantity, 1¼ ton.

Potatoes.—Quantity below average; quality good; a little disease, which appeared early, about 1st August; crop about 4½ tons.

Turnip crop very unequal; rather over average. Swedes, say 20 to 24 tons; yellows much affected with finger-and-toe and mildew, say 12 to 14 tons. Crop brairded well; no second sowings.

No injury by insects; not more than usual by weeds.

Live Stock.—Pastures grew well, early, and of fine quality, but much

affected in growth in July by severe drought; growth very rich in August and September. Stock throve well, and were free from disease. *Clip of wool*—Average.

Ross-shire (District of Tain, Cromarty, and Invergordon). *Wheat.*—30 bushels; extra good; grain and straw; 3½ to 4 bushels seed.

Barley.—38 bushels; grain and straw better; 3 to 3½ bushels seed.

Oats.—46 bushels; straw, extra quality; grain, average, have had better colour; 4 bushels seed.

Harvest began about fourteen days earlier than average.

Hay.—1 to 1¼ ton; quality good; less weight than last year. No *meadow* grown.

Potatoes.—Better, 6 to 7 tons; no disease; no very new varieties grown.

Turnips.—Better, especially swedes; quality good. Yellow, average only; swedes 20 to 24 tons. Very good braird; no second sowing.

No injury by insects; not more than usual by weeds.

Live Stock.—Pastures barely average growth; better quality. Stock throve well, and were quite free from disease. *Clip of wool*—Quite average quality.

Caithness-shire.—No *wheat* grown.

Barley.—An average crop of grain, 32 bushels; straw, short; grain good colour and fair weight; seed, 4 bushels.

Oats.—A good crop of grain in most places; straw very short, being one-third less than an average; quantity about 40 bushels on some fields, while on the same farm on other fields 24 bushels would be all the crop. The long-continued drought told heavily on the drier soils, whilst mildew did damage on wet lands. Seed, 5 to 6 bushels.

Harvest began about the 26th August, being ten days earlier than average seasons; crop secured by the end of September; except on late farms.

Hay crop almost a complete failure in many instances; ½ ton would represent the yield, consisting almost exclusively of ryegrass. *Meadow-hay*—A poor crop.

Potatoes.—A good crop; free of disease; quantity from 9 to 10 tons. Champion variety mostly grown.

Turnips.—All the earlier sown turnips a good sound crop, but later sown have grown badly. The earlier brairded well, and came quickly to hoe; but later all came up in patches; and owing to continued drought made little progress until rain came, which was much too late to help the crop.

A good deal of damage was done to the later sown turnips by saw-fly, and a maggot which burrowed at the neck of the turnip and upper portion of the bulb. Crops were fairly clear of weeds, except where corn did not come away owing to drought; on these fields a deal of charlock appeared, and killed out the corn-plant.

Live Stock.—The pastures after the 1st July were very bare, and stock, owing to scarcity of grass, did not do well on hill farms. All sheep had a good time up to the beginning of October, when rain set in accompanied with very high winds, and has continued up to the date of writing, 1st February; in consequence of this ewes did no good after October, and lost condition, the result being a very protracted tupping-time, which must result in a poor drop of lambs. Sheep and cattle have all been free of disease. *Clip of wool*—An average as to quantity and quality.

Orkney. *Wheat.*—None grown.

Average yield of *bere*, about 30 bushels, weighing about 47 lb.; seed, 3½ to 4½ bushels.

Oats.—The grain of good quality, yielding about 28 bushels, and weighing about 39 lb.; straw of both bere and oats one-third below the average bulk; seed, 4 to 6 bushels.

Harvest commenced about 1st September, being a fortnight earlier than usual, and at least five weeks earlier than last year.

Hay.—Owing to the extreme drought hay was a very light crop, being only about 15 cwt.

Potatoes.—An excellent crop, averaging about 7 tons.

Turnips.—Swedes and early-sown yellow turnips a good crop; but much of the later-sown yellow turnips did not germinate until after the 17th July, when the long drought terminated and rain fell in abundance. Owing to numerous large blanks the average yield only about 8 tons, being rather below last year's average, but the quality good, and very little disease.

Lea oats were much injured by grub. There was no damage by weeds.

Live Stock.—Pastures were very bare till the rain came, but after this they were of average growth and quality. Stock throve well, and cattle and sheep were free from disease. The *clip of wool* was under the average.

SHETLAND (Unst District). *Oats.*—Straw a light crop; grain good; might be about 22 to 24 bushels; seed, 5 to 5½ bushels.

Harvest began about three weeks before usual time.

The *hay* crop was of good quality, but under average in quantity; cannot say the weight. *Meadow-hay*—Less than last year.

Potatoes.—The yield, as compared with last year, was more than double. No disease till after lifting; about the time of lifting heavy rains came on, and in some cases a good lot rotted after being taken up.

The *turnip* crop was good, and fully an average.

No injury by insects or weeds.

Live Stock.—Pastures. The growth in most places was less than last year, but quality was good; it was an exceptionally dry year. Stock throve on them, and were free from disease. *Clip of wool*—About an average.

SHETLAND (District of Lerwick). *Barley.*—Grain, excellent quality; and larger quantity than last year; straw lighter than last year, but of superior quality; dry spring and dry, hot summer.

Oats.—Grain, large yield of good quality, better than last year; straw better than last year in quality, but less bulk.

Harvest, about three weeks before the usual time.

Hay.—The quantity of both ryegrass and clover was less than last year; the quality was excellent, and better than last year. *Meadow-hay*—Owing to the dry season the quantity was rather less than last year.

Potatoes.—The yield was rather less than last year, but the crop was good; there was no disease; no new varieties.

Turnips.—A fine crop; the weight was more than last year and the quality as good. Except in a very few cases only one sowing required; the exceptions can be accounted for by the dryness of the weather.

No damage by insects. Very few weeds; no damage.

Live Stock.—In June and July the pasture on dry ground was very much burnt up; on the whole, the growth was below an average, and inferior to last year; the quality was good. Stock throve fairly well; no disease. *Clip of wool*—The quality was very good, and the quantity about an average.

THE METEOROLOGY OF 1893.

The following table gives a comparison of the winds and sunshine of 1893 as compared with the averages of previous years :—

TABLE SHOWING FOR WIND DIRECTION AND FORCE, AND FOR SUNSHINE, THE EXCESS ABOVE, OR THE DEFECT FROM, THE AVERAGES OF PREVIOUS YEARS.

	Direction of Wind—Days.									Wind Force.	Hours of Sunshine.
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calms.		
										lb. p. sq. ft.	
January	1	1	2	−1	−2	−3	1	1	0	0.26	−13
February	−1	0	0	−1	1	−1	1	0	0	0.32	−22
March	−1	−1	−1	0	−1	0	4	−1	1	−0.08	22
April	0	0	0	−1	0	−1	1	0	1	−0.59	24
May	−1	−1	2	1	1	−1	0	−1	0	−0.01	−29
June	1	1	0	0	0	−2	0	0	0	−0.42	−14
July	1	1	1	1	−1	−2	−1	0	0	0.08	−55
August	0	−1	−1	0	1	0	1	0	0	−0.30	−9
September	1	−1	−1	−1	−1	−1	3	1	0	0.42	−21
October	−1	−1	−2	−2	0	1	4	0	1	0.09	−5
November	3	2	0	−2	−2	−2	1	0	0	0.66	−21
December	−2	−1	−1	−1	1	3	3	−1	−1	1.07	−15
Year	1	−1	−1	−7	−3	−9	18	−1	2	0.13	−158

The year 1893 was thus characterised by a large predominance of westerly winds, which prevailed eighteen days above the average, and a corresponding diminution of south-easterly, southerly, and south-westerly, which blew nineteen days under their average. The autumn and winter were remarkable for stronger winds than usual, and the spring and summer for lighter. But the most pronounced feature of the weather of the year was the high temperature which ruled for the six months from March to August, being much higher than any year since 1870. During these months the weather was strongly anticyclonic, and accompanying the high barometers strong sunshine prevailed. The temperature was everywhere above the average of past years, the excess being greatest in inland stations, where it amounted to nearly 2°.0, and least in the extreme north and north-west, the excess there being only half a degree.

The rainfall of all Scotland for the year was 7 per cent under the average, but its geographical distribution was remarkable. To the north of a line drawn from Islay to Banff it was above the average, but to the south of that line below it. The greatest

excess was in the north-west, where it amounted to 33 per cent, and the greatest deficiency from Perth to Stirling, and over Tweeddale, where it was 33 per cent below the average. The dull rainy weather which prevailed during large portions of the year north of the Grampians kept the sunshine of Scotland as a whole under the monthly averages, except in March and April, during 1893, which was a year of such brilliant sunshine over all parts of North Britain south of this mountain range.

JANUARY.—The mean temperature of the month was 36°.3, or 0°.8 under the mean, the days being 0°.6 and the nights 1°.0 under the average. In the extreme south-west, temperature was more than two degrees under the average, but at coast stations generally, north of the Grampians, only half a degree.

The rainfall was 2.22 inches, or 1.69 inch less than the average. In Lower Deeside, Shetland, and most of the counties of Caithness and Sutherland, it was a little above the average, but elsewhere over the whole country it was under the average, and very largely so to the south of a line drawn from Arbroath to Crinan. Over large districts the deficiency was from a half to three-fourths the usual fall. On the one hand there was an excess of about 30 per cent in Shetland and at Cape Wrath and Aberdeen, whereas on the other hand there was a deficiency of 86 per cent at Stobo Castle, and 75 at Polkemmet, Pladda, Ayr, and Turnbery.

FEBRUARY.—The mean temperature was 38°.4, being the average of the month, the temperature of the days and nights being also the average. Generally in the east temperature was under the mean, but in the west and inland situations above it; but the departures were in all cases small, the extremes being a degree in excess in the Glasgow district and half a degree less than the average in the east from the Firth of Forth to Shetland.

The rainfall was 4.01 inches, or 1.01 inch above the average. It was unequally distributed over the country. The excess was very large from the Moray Firth to the Grampians, being double the usual amount at several places; and large from the Firth of Forth to Tweeddale, where it was upwards of 70 per cent above the average. The rainfall was a little deficient in the counties of Selkirk, Lanark, Renfrew, and Ayr; in the west from Ardnamurchan northwards; in Sutherland, Caithness, and the east of Aberdeen and Kincardine.

MARCH.—The mean temperature was 42°.7, or 3°.3 above the average, the days being 5°.1 and the nights 1°.4 in excess. Thus the high temperature was largely occasioned by the strong sunshine which prevailed. The weather was eminently of the anticyclonic type, the barometer being high and steady, the air dry and warm, the daily range of temperature very large, the

humidity small, and the sky bright and clear. As usual in such conditions, the highest temperatures occurred in inland situations, rising at Stronvar and Lednathie to 4°.3 above their averages, whereas at many coast stations the excess was less than three degrees.

The rainfall was 1.54 inch, or 1.24 inch less than the average. In the west, from Skye to Cape Wrath, the amounts were above the average, the excess at Glencarron, where 9.14 inches fell, being 37 per cent. At all other places the rainfall was deficient, and very largely so over the whole of the eastern slopes of the country. The largest deficiency occurred from the Moray Firth to Strathtay, being 82 per cent of the average at Fettercairn and Logie Coldstone.

April.—The mean temperature was 47°.2, or 3°.1 above the average, the days being 5°.3 and the nights 1°.0 warmer than usual. Here again, as in March, the higher temperature was chiefly due to the strong sunshine which prevailed, and the duration of the sunshine was again considerably above the average. The character of the weather was eminently anti-cyclonic, barometric pressure very high, the daily range of temperature the largest on record, cloud 21 per cent under the average, and the wind normal in direction but in force lower than any recorded since 1864. Everywhere temperature was largely in excess of the average, the greatest excess being in southern counties and in inland situations, and the least in the south-east. Thus temperature was above the average 4°.3 at Glasgow, 4°.6 at Stobo and Dumfries, 4°.2 at Glenlee, and 4°.0 at Pinmore; but less than two degrees at strictly coast stations from Fraserburgh to the Tweed, whilst at coast stations in the west it was double that amount. This was the warmest April since 1856.

The rainfall was 1.40 inch, or 0.75 inch under the average. Except at a few stations in the west of Argyllshire the rainfall was everywhere under the average, but the deficiency was generally not quite so great as in March. In the west of Islay a half more rain fell than usual in April, but at eastern and south-western stations the amounts were only about half the usual rainfall.

May.—The mean temperature was 52°.4, or 3°.5 above the average, the days and nights being equally in excess. The geographical distribution of the excess was similar to the preceding month, except that the least excess was not along the east of Scotland, but in Caithness, Orkney, and Shetland, where it scarcely amounted to 2°.0, whereas at many inland stations the excess exceeded 4°.0.

The rainfall was 1.88 inch, or 0.41 inch less than the average. The greatest deficiency occurred at eastern stations from the

Pentland Firth to the Tweed, the largest deficiencies being, in percentages below their averages, 72 at Perth, 65 at Logie Coldstone, 50 at Cromarty, Braemar, Lednathie, Ochtertyre, and St Abb's. The rainfall was also under the average in the south-western counties, the greatest deficiency being 62 per cent at Pladda and 38 at Ayr. The rainfall rose above the average in a number of restricted scattered districts in the counties of Lanark, Renfrew, Argyll, Ross, and Sutherland, but the excess did not exceed a third of the average.

JUNE.—The mean temperature was 57°.0, or 2°.2 above the average, the days being 2°.9 and the nights 1°.4 in excess. As in the previous months, the greatest excess was at inland and south-western stations, where in some places the excess was 4°.0; and the least excess in the extreme north, amounting in Shetland to scarcely a degree above the average. Though the sunshine was 14 hours under the average, yet the black-bulb thermometer in the sun was 9°.4 above the mean, thus indicating very strong insolation during the month, or strong heating in the sun's rays.

The rainfall was 2.12 inches, or 0.37 inch under the average. Its distribution over the country was very unequal, being largely determined by the local heavy rains which fell on the 22d and 23d. On these two days there fell 4.20 inches at North Esk reservoir; 3.30 inches at Rosewell, and about 2.00 inches at a large number of eastern stations. The result was a rainfall above the average at nearly every station in the east, from the Moray Firth to the Tweed, the largest percentages of excess being 96 at North Esk reservoir, 90 at Rosewell, and 78 at Haddington. Elsewhere in Scotland the rainfall was under the average, and greatly so over large districts. Thus from Ardnamurchan to the Crinan the deficiency was from 70 to 90 per cent; the Firth of Clyde 23 to 78 per cent; and the northern counties and islands 35 to 78 per cent.

JULY.—The mean temperature was 57°.6, or 0°.4 above the average, the days and the nights being equally in excess. The distribution of temperature was more unequal than it has been for some months. At strictly coast stations from Fraserburgh to the Tweed temperature was from 0°.2 to 1°.0 under the average, whereas in all other districts in Scotland it was above the average, the greatest excess being about 3°.0 for some distance round the Oban district. Thus, while temperature was about a degree under the average to the east of the Grampian range, it was three degrees above it on the west side of the same range. Sunshine was greatly under the average, and cloud a good deal above it.

The rainfall was 3.35 inches, or 0.25 inch above the average, but it was distributed among the stations with singular in-

equality, due largely to the unequal distribution of the thunder-storms with their accompanying heavy rains. Generally at eastern stations from Aberdeen southward, and at inland stations, the rainfall was deficient, the greatest deficiency being 48 per cent at Arbroath and Aviemore. Elsewhere the rainfall was in excess, the greatest excess being 124 per cent at Poltalloch, and 113 per cent at the neighbouring station, Fladda. In the other districts an excess from a third to a half above the average was common.

AUGUST.—The mean temperature was 59°.4, or 2°.8 above the average, the days being 3°.4 and the nights 2°.2 in excess. The greatest excess of temperature was south of the Forth and Clyde, and at inland stations south of Inverness, where it was generally 3°.5, rising to 4°.0 in Berwickshire; and the least excess in the northern islands, where in Shetland it was only half a degree. Thus these northern islands had a summer relatively much cooler than it was farther south. This is the highest mean temperature recorded for August since 1857.

The rainfall was 3.56 inches, being the average, but its distribution over Scotland was extremely irregular. It was under the average nearly everywhere from the Grampians to the Cheviots, the Firth of Clyde and districts adjacent, and large portions of the eastern division of the counties of Inverness, Ross, Caithness, and Orkney. The amounts were only about half the usual fall for August in the east of Aberdeenshire and Berwickshire. Elsewhere the rainfall was above the average, the greatest excesses being, in percentages above the average, 86 at Stornoway, 73 at Bressay, and 69 at Gordon Castle. It deserves to be placed on record that over large breadths of the country the grain crops were cut and secured in the stackyards in excellent condition by the end of the month. The black-bulb thermometer in the sun was 10°.2 above the average, thus pointing to unusually strong insolation while it lasted.

SEPTEMBER.—The mean temperature was 51°.8, or 1°.0 under the average, the days being 0°.4 and the nights 1°.5 colder than usual. The deficiency of temperature was greatest in the eastern side of the country, where it was generally from 1°.5 to 2°.0 under the average; whereas at stations in the extreme west it was nearly the average. Temperature fell below freezing at many places on the 11th, 21st, 22d, and 23d, accompanied in some places with heavy showers of snow.

The rainfall was 3.45 inches, or 0.22 inch under the average. To the north of the Grampians it was above the average, the greatest excesses in percentages being 128 at Scourie, 125 at Glencarron, and 100 at Thurso and Gordon Castle. As the rains fell chiefly with north-westerly winds, the rainfall was under the average in all districts south of these mountains, the

greatest deficiencies in percentages being 74 at Drumlanrig; 67 at Ochtertyre, Dollar, and Marchmont; 63 at Perth, Stobo, Kelso, and Hawick; and over large districts less than half the usual September rainfall was collected. On the 12th, 3.59 inches fell at Glencarron, and 2.91 inches at Fort William. South of the Grampians the weather was fine and dry up to the 20th, and with this weather the grain crop was secured in prime condition, but after this date the weather was wet till the end of the month. On the other hand, north of these mountains, wet weather generally prevailed throughout the month, and crops in late districts not yet in the stackyards suffered much.

OCTOBER.—The mean temperature was 47°.0, or 0°.6 above the average, the days being 1°.5 above, and the nights 0°.3 under, the mean. To the south of the Grampians it was fully a degree above the average, but in the north-west of Scotland and north-east of Aberdeenshire it was nearly half a degree under it. At stations near the Solway it was about the mean.

The rainfall was 4.51 inches, or 0.45 inch above the average. In eastern districts from the Spey to the Tweed only about half the average rainfall was collected, except in the counties of Forfar and Edinburgh, where the average was exceeded. It was also under the average, though slightly, in Galloway. In all other parts of the country it was in excess of the average, generally from a half more to double the October average being recorded. The extreme falls collected were 14.85 inches at Glencarron, and 1.14 inch at Milne Graden.

NOVEMBER.—The mean temperature was 39°.5, or 1°.1 under the average, due to a predominance of northerly and a deficiency of southerly winds, the result of barometric pressure being consideraby higher in the west than in the east. The days were 0°.9 and the nights 1°.4 colder than usual in this month. In the south-eastern counties the deficiency of temperature was less than half a degree; this steadily increased on proceeding to the north-west, where the deficiency exceeded three degrees.

The rainfall was 3.66 inches, or 0.16 inch under the average. Its distribution was very unequal, As the rain fell chiefly with the prevailing northerly winds, it followed, just as in September, that it was above the average to the north of the Grampians, but under it to the south of this range. Thus the percentages of excess were 202 at Thurso, 115 in Shetland, and 102 at Scourie; and the percentages of deficiency 71 at Perth and 52 at Dundee. The rainfall of September and November of this year shows in a striking manner how the southern half of Scotland is protected from heavy and protracted rains when the rain is precipitated by northerly winds.

This month will be long remembered for the great storm

which swept over the country from the 17th to the 19th, when the number of wrecks by sea and destruction of forests by land were wellnigh unprecedented.

DECEMBER.—The mean temperature was 40°.5, or 2°.7 above the average, the days being 2°.9 and the nights 2°.5 warmer than usual. The greatest excess of temperature was in southern and inland situations, whereas in Strathearn it amounted to 4°.0; and the least in the west and north, where it only reached about a degree, and was relatively much smaller at all stations near the coasts.

The rainfall was 4.67 inches, or 0.70 inch above the average. It was above the average everywhere in the west, and also in those eastern districts at a considerable distance from the sea. The deficiency over strictly eastern districts was generally from a third to half the average. In the west the excess above the average increased on advancing northwards. The percentages of excess were 88 at Fort Augustus; 107 at Fort William; 153 at Sumburgh Head; and 195 at Lerwick. The rainfall and temperature of the month, with the manner of the distribution over different parts of the country, are to be referred immediately to the great prevalence of south-westerly winds, and to the unusual force with which these blew; and these in their turn were the inevitable result of a low barometric pressure in the west, which as compared with the east was much lower than usually occurs in December.

The harvest of 1893 was, owing to the fine summer, from two to three weeks earlier than usual over the lower-lying districts of the country, but from three to four weeks earlier in upland districts.

Wheat was everywhere an average, or, more generally, a full average crop, particularly as regards the quality of the grain; and the same remark is applicable to the *barley* crop. *Oats*, owing to the dry weather which prevailed in some districts, were short in the straw, but the grain everywhere was good, and the crop in several districts a full average one. Owing to the early harvest, the heavy rains in September in the north did comparatively little damage in upland situations.

Potatoes were also a good average crop, with very little disease, except in the districts of Edinburgh, Haddington, Bute, Mid-Lanark, Dumbarton, and Coupar-Angus, where Regents and some early varieties suffered, the loss in the Dumbarton district being from 30 to 50 per cent.

Over considerably more than half the districts, *turnips* were an exceptionally heavy crop, owing largely to the severity of the drought having terminated in Scotland generally about June 22.

AGRICULTURAL STATISTICS OF SCOTLAND.—Returned upon 5th June 1893.—(*Compiled from the Government Returns.*)

Table No. 1.—Acreage under each kind of Crop, Bare Fallow, and Grass, in each County of Scotland.

Counties.	Total Acreage under Crops, Bare Fallow, and Grass.	Corn Crops. Wheat.	Barley or Bere.	Oats.	Rye.	Beans.	Peas.	Total.	Green Crops. Potatoes.	Turnips.	Mangel.	Cabbage, Kohl-rabi, and Rape.	Vetches or Tares.	Other Green Crops.	Total.	Clover, Sainfoin, and Grasses under Rotation.	Permanent Pasture (exclusive of Mountain Land).	Flax.	Small Fruit.	Bare Fallow or Uncropped Arable Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1. Aberdeen . .	629,240	10	20,410	193,708	260	404	386	215,173	7,677	91,283	5	74	2,547	165	101,751	275,869	35,839	4	365	239
2. Argyle . .	132,935	3	1,502	18,653	400	94	2	20,654	5,148	5,479	29	106	28	46	10,836	26,266	74,867	..	24	338
3. Ayr . . .	322,512	1,382	1,097	49,400	280	687	5	52,851	7,955	7,736	433	528	60	381	17,093	100,818	151,548	..	136	66
4. Banff . . .	159,737	9	7,768	49,621	124	78	84	57,684	2,035	22,695	4	2	990	16	25,742	66,227	9,983	1	21	179
5. Berwick . .	193,381	1,996	18,709	35,957	28	1,021	64	57,775	2,349	27,929	68	427	960	10	31,743	61,532	42,284	..	22	25
6. Bute . . .	25,595	..	95	5,184	94	53	5	5,431	978	1,490	5	28	10	12	2,523	9,020	8,452	..	56	113
7. Caithness . .	109,776	..	1,031	34,781	50	8	20	35,890	1,752	13,982	3	150	438	13	16,338	31,846	25,650	..	4	48
8. Clackmannan .	15,719	222	449	3,545	22	575	..	4,813	357	806	3	30	46	2	1,244	3,196	6,231	..	11	224
9. Dumbarton .	51,178	826	156	7,304	24	183	5	8,498	2,231	1,559	22	188	79	25	4,104	15,533	22,913	..	62	68
10. Dumfries . .	260,423	50	500	46,726	20	38	1	47,335	4,029	20,009	51	597	64	65	24,815	82,668	105,459	..	74	72
11. Edinburgh . .	137,878	3,461	4,288	25,752	167	175	65	33,908	4,876	12,459	20	714	480	437	18,986	36,166	48,485	..	265	68
12. Elgin . . .	101,596	1,357	13,515	21,455	945	33	11	37,314	1,817	16,036	3	6	477	9	18,348	37,615	8,218	..	20	81
13. Fife . . .	257,037	9,479	22,680	40,972	991	1,299	30	75,451	15,252	26,259	8	177	984	60	42,740	62,774	75,131	2	145	794
14. Forfar . .	252,817	6,902	27,847	52,556	912	544	39	88,800	13,769	34,895	11	122	764	109	49,670	81,937	32,170	..	183	57
15. Haddington .	111,939	5,922	13,748	18,789	7	718	47	39,231	7,802	16,183	25	365	301	267	24,943	29,107	18,112	..	410	156
16. Inverness . .	150,856	18	7,114	30,637	770	10	26	38,575	6,459	10,983	1	13	149	26	17,631	31,213	62,405	..	33	499
17. Kincardine .	120,588	286	10,893	31,021	65	495	41	42,801	2,834	17,877	..	10	517	51	21,289	44,127	12,270	..	86	15
18. Kinross . .	36,192	8	365	6,240	72	21	1	6,707	574	2,726	..	57	70	2	3,429	10,955	15,087	..	3	11
19. Kirkcudbright .	191,156	59	27	29,004	25	80	1	29,196	1,764	13,627	30	1,008	40	18	16,487	60,865	84,470	..	27	111
20. Lanark . .	256,939	1,753	378	40,647	17	876	18	43,689	4,585	9,327	17	1,195	408	227	15,759	96,280	99,152	..	1,790	269
21. Linlithgow .	59,071	1,199	3,026	10,437	8	431	19	15,120	1,680	4,226	5	100	274	10	6,295	15,199	22,283	..	19	155
22. Nairn . . .	26,039	1	3,167	5,723	213	..	6	9,110	354	4,237	..	4	60	1	4,656	8,961	3,260	..	4	48
23. Orkney . .	105,744	..	5,238	33,017	..	10	33	38,241	2,905	14,358	..	48	269	3	17,583	32,226	17,413	..	..	224
24. Shetland . .	54,471	..	2,061	7,228	1	..	..	9,290	3,198	1,290	..	456	..	3	4,947	951	38,761	..	..	522
25. Peebles . .	42,981	9	381	8,335	..	..	5	8,730	421	4,196	1	245	90	..	4,953	12,860	16,406	..	5	27
26. Perth . . .	337,084	4,269	15,226	67,620	667	2,335	19	90,136	14,319	29,835	13	239	475	52	44,933	99,168	100,579	..	692	1,576
27. Renfrew . .	94,240	1,450	115	12,950	49	354	5	14,923	3,254	2,444	33	303	50	57	6,141	22,120	50,927	2	76	51
28. Ross & Cromarty	187,630	825	11,007	32,322	788	1	128	44,971	8,482	16,349	7	14	560	7	25,419	40,040	26,902	..	23	275
29. Roxburgh . .	182,475	400	12,352	30,336	57	168	47	43,360	1,469	22,779	65	502	385	15	25,215	59,547	54,267	..	57	29
30. Selkirk . .	30,838	2	265	5,145	..	..	12	5,424	218	2,949	..	196	61	2	3,426	10,444	11,505	..	39	..
31. Stirling . .	118,219	1,738	3,646	19,171	68	3,055	7	27,685	3,360	4,535	10	161	321	53	8,440	35,319	45,370	..	119	1,286
32. Sutherland .	31,566	6	1,698	7,845	69	2	9	9,629	1,738	3,044	..	11	37	..	4,830	8,038	9,019	..	5	45
33. Wigtown . .	152,773	451	892	34,442	49	227	1	36,062	1,603	16,173	110	191	126	134	18,337	67,637	30,365	..	13	359
Total . .	4,890,175	44,093	211,644	1,016,518	7,242	13,975	1,042	1,294,514	137,244	479,755	982	8,267	12,120	2,278	640,646	1,576,524	1,365,783	9	4,789	7,910

TABLE No. 2.—ESTIMATED TOTAL PRODUCE OF WHEAT, BARLEY, AND OATS in 1893, ACREAGE and Estimated Average YIELD per Acre, Estimated Ordinary Average YIELD, and Estimated YIELD per Acre in 1892 and 1891, in each of the COUNTIES of SCOTLAND.

COUNTIES.	WHEAT.						BARLEY, INCLUDING BERE.						OATS.					
	Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.				Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.				Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.			
			1893.	Ordinary Average.*	1892.	1891.			1893.	Ordinary Average.*	1892.	1891.			1893.	Ordinary Average.*	1892.	1891.
	Bush.	Acres.	Bush.	Bush	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.
Aberdeen	226	10	22.60	36.92	29.33	26.00	713,106	20,410	34.94	32.41	32.70	31.84	6,878,809	193,703	35.51	33.05	30.45	33.53
Argyle	84	3	28.00	—	..	28.00	50,529	1,502	33.64	37.52	30.44	25.96	593,721	18,653	31.83	32.96	31.09	31.27
Ayr	55,710	1,382	40 31	31.89	37.29	38.73	46,152	1,097	42.07	40.34	40.73	39.76	2,403,609	49,400	48.66	46.29	41.35	46.33
Banff	286	9	31.78	35.77	26.31	26.80	298,909	7,768	38.48	35.43	33.16	29.64	1,908,440	49,621	38.46	32.70	30.99	31.89
Berwick	65,234	1,996	32.68	30.34	31.95	34.59	654,310	18,709	34.97	36.32	34.64	32.99	1,351,452	35,957	37.58	39.56	36.73	32.77
Bute	..	..	..	..	28.00	..	3,656	95	38.48	34.11	34.31	35.24	180,609	5,184	34.84	31.12	33.36	27.44
Caithness	..	..	..	21.14	10.00	10.00	37,765	1,031	36.63	29.96	36.36	30.98	1,220,610	34,781	35.09	30.73	33.98	29.39
Clackmannan	7,762	222	34.96	30.85	33.61	35.00	15,825	449	35.24	33.50	35.11	37.76	158,033	3,545	44.58	33.74	42.02	44.75
Dumbarton	33,466	826	40.52	30.72	38.21	39.37	6,914	156	44.32	33.21	39.21	39.94	338,809	7,304	46.32	35.66	39.55	39.76
Dumfries	1,829	50	36.58	33.56	36.86	34.39	16,174	500	32.35	36.16	35.33	33.38	1,519,045	46,726	32.51	35.76	33.75	32.14
Edinburgh	159,522	3,461	46.09	36.71	43.61	44.78	198,637	4,288	46.32	39.60	44.03	42.63	1,188,547	25,752	46.15	39.75	43.90	43.29
Elgin or Moray	46,653	1,357	34.38	30.09	34.75	31.49	454,957	13,513	33.67	35.48	33.94	32.35	757,002	21,455	35.28	35.09	33.52	35.19
Fife	322,208	9,479	33.99	30.16	33.39	33.70	753,003	22,680	33.20	34.00	32.43	34.05	1,529,445	40,972	37.33	36.87	35.27	35.57
Forfar	225,762	6,902	32.71	33.45	31.79	35.88	1,060,042	27,847	38.07	35.26	38.65	36.13	2,472,408	52,556	47.04	40.70	44.30	40.63
Haddington	224,063	5,922	37.84	35.16	35.94	38.96	594,131	13,748	43.22	40.64	40.56	40.13	905,251	18,789	48.18	44.44	45.89	44.86
Inverness	715	18	39.72	26.00	41.24	40.71	250,307	7,114	35.19	30.95	37.68	39.22	891,299	30,637	29.09	29.81	27.22	36.02
Kincardine	10,141	286	35.46	34.12	35.12	34.94	384,636	10,893	35 31	32.16	33.96	33.89	1,246,477	31,021	40.18	35.86	37.39	36.51
Kinross	240	8	30.00	28.85	30.44	30.00	12,853	365	35.21	29.82	35.59	38.18	214,956	6,240	34.45	32.13	34.38	36.32
Kirkcudbright	1,993	59	33.78	33.31	30.42	31.27	870	27	32.22	31.92	33.91	29.94	971,239	29,004	33.49	34.23	35.22	31.33
Lanark	71,085	1,753	40.55	35.95	34.91	37.71	15,447	378	40.87	34.21	36.30	39.96	1,630,196	40,647	40.11	35.03	34.87	35.70
Linlithgow	46,238	1,199	38.56	34.71	37.58	38.47	134,027	3,026	44.29	42.65	41.96	42.69	455,127	10,437	43.61	42.13	43.03	44.33
Nairn	38	1	38.00	—	32.00	28.18	114,165	3,167	36.05	34.81	36.39	35.14	213,801	5,723	37 36	35.25	36.38	35.16
Orkney	..	..	..	..	..	..	167,923	5,238	32.06	36.13	35.04	34.03	931,126	33,017	28.20	34.42	26.54	26.61
Peebles	306	9	34.00	—	31.88	..	13,629	381	35.77	31.28	32.87	32.77	307,798	8,335	36 93	34.02	34.01	33.95
Perth	155,678	4,269	36.47	33.80	32.54	38.79	520,196	15,226	34.16	34.18	36.89	33.71	2,258,542	67,620	33.40	36.30	36.04	34.53
Renfrew	61,983	1,450	42.75	33.64	38.62	40.97	5,338	115	46.42	37.57	41.86	44.95	616,762	12,950	47.63	42.09	42.64	45.66
Ross and Cromarty	36,445	825	44.18	34.34	44.70	42.38	449,839	11,007	40.87	31.95	41.25	39.93	1,299,410	32,322	40.20	36.17	40.60	42.14
Roxburgh	11,652	400	29.13	30.77	33.48	36.06	454,919	12,352	36.83	35.51	35.23	33.36	1,108,988	30,336	36.56	37.02	36.23	32.10
Selkirk	60	2	30.00	26.00	..	..	8,669	265	32.71	29.11	29 48	29.80	176,897	5,145	34.38	29.67	30.50	31.21
Shetland	..	..	..	..	..	..	49,845	2,061	24.18	20.47	13.49	21.52	185,466	7,228	25.66	20.29	12.72	16.34
Stirling	61,310	1,738	35.28	30.17	30.76	35.13	130,680	3,646	35.84	31.32	32.24	35.65	795,602	19,171	41.50	31.95	37.37	38.64
Sutherland	150	6	25.00	—	..	30.50	56,139	1,698	33.06	30.33	33.98	35.16	235,089	7,845	29.97	36.96	30.86	39.67
Wigtown	12,045	451	26.71	30.11	26.85	26.86	26,106	892	29.27	30.57	32.71	30.57	1,326,352	34,442	38.51	36.42	43.41	32.08
Total	1,612,884	44,093	36.58	..	..	..	7,699,698	211,644	36.38	..	..	..	38,270,477	1,016,518	37.65	..	..	..

* As computed from Returns furnished by Estimators in 1885.

TABLE No. 3.—ESTIMATED TOTAL PRODUCE OF BEANS, PEAS, AND POTATOES in the Year 1893, ACREAGE and Estimated Average YIELD per Acre, Estimated Ordinary Average YIELD, and Estimated YIELD per Acre in 1892 and 1891, in each of the COUNTIES of SCOTLAND.

COUNTIES.	BEANS.						PEAS.						POTATOES.					
	Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.				Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.				Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.			
			1893.	Ordinary Average.*	1892.	1891.			1893.	Ordinary Average.*	1892.	1891.			1893.	Ordinary Average.*	1892.	1891.
	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.
Aberdeen	10,057	404	24.89	28.26	22.57	23.59	9,128	380	23.65	23.27	18.57	23.14	50,182	7,677	6.54	5.40	4.76	4.26
Argyle	1,933	94	20.56	35.13	19.20	16.89	36	2	18.00	37.62	17.00	23.50	28,430	5,148	5.52	5.47	4.31	5.95
Ayr	24,162	687	35.17	34.47	31.74	33.46	188	5	37.60	34.96	30.50	35.67	58,128	7,955	7.31	7.03	6.59	6.35
Banff	1,668	78	21.38	27.29	24.11	24.86	1,879	84	22.37	23.02	18.74	20.24	12,744	2,035	6.26	4.62	5.25	3.21
Berwick	31,974	1,021	31.32	33.91	30.68	30.97	1,680	64	26.25	24.75	21.82	24.06	13,977	2,349	5.95	5.92	5.76	5.91
Bute	1,073	53	20.25	30.96	21.67	17.68	80	5	18.00	27.83	15.75	15.88	6,817	978	6.97	6.41	5.27	6.46
Caithness	64	8	8.00	—	5.00	8.00	280	20	14.00	—	8.00	12.00	12,329	1,752	7.04	5.52	6.31	1.86
Clackmannan	16,333	575	28.41	26.97	29.63	30.51	..	..	..	—	32.00	33.20	3,346	357	9.37	5.43	6.61	7.31
Dumbarton	5,878	183	32.12	27.74	26.66	30.74	93	5	18.60	27.24	14.50	17.67	19,846	2,231	8.90	6.70	6.83	9.11
Dumfries	824	38	21.68	29.97	23.73	31.42	21	1	21.00	33.73	20.00	24.33	28,516	4,029	7.08	6.24	5.17	6.05
Edinburgh	5,995	175	34.26	35.58	30.83	33.19	1,601	65	24.63	27.51	22.53	25.29	37,847	4,876	7.76	5.89	6.28	6.90
Elgin or Moray	824	33	24.97	31.93	23.59	29.14	249	11	22.64	22.06	22.13	21.80	9,335	1,817	5.14	3.99	4.37	3.65
Fife	46,299	1,299	35.64	34.45	33.86	34.54	897	30	29.90	30.12	30.58	26.25	78,555	15,252	5.15	4.45	4.56	5.32
Forfar	17,217	544	31.65	33.85	31.17	31.63	1,087	39	27.87	25.97	27.92	26.29	73,645	13,769	5.35	5.74	5.03	6.10
Haddington	23,750	718	33.08	33.54	32.84	32.72	1,175	47	25.00	25.89	25.03	25.98	54,696	7,802	7.01	6.39	6.41	6.96
Inverness	172	10	17.20	35.50	..	..	631	26	24.27	27.31	26.08	29.05	36,503	6,459	5.65	4.90	4.53	4.21
Kincardine	16,277	495	32.88	31.33	33.81	36.66	966	41	23.56	24.00	25.50	26.63	19,634	2,834	6.93	6.46	6.57	6.32
Kinross	726	21	34.57	23.00	32.84	32.00	30	1	30.00	..	..	..	3,754	574	6.54	5.90	5.48	6.27
Kirkcudbright	2,812	80	35.15	31.26	35.91	33.64	26	1	26.00	31.00	28.00	24.00	10,848	1,764	6.15	6.10	5.74	5.96
Lanark	30,805	876	35.17	33.60	32.98	35.21	512	18	28.44	26.00	26.89	29.67	36,164	4,585	7.89	6.52	6.55	7.29
Linlithgow	13,966	431	32.40	34.07	29.94	33.86	491	19	25.84	—	26.33	26.48	12,173	1,680	7.25	4.95	5.67	6.46
Nairn	..	..	..	28.00	..	..	142	6	23.67	12.44	24.50	18.00	1,653	354	4.67	5.09	6.23	3.22
Orkney	† —	—	—	—	—	—	† —	—	—	—	—	—	25,412	2,905	8.75	7.54	7.72	3.21
Peebles	..	..	..	30.00	24.50	25.00	143	5	28.60	27.39	22.42	22.67	3,379	421	8.03	5.82	5.38	6.12
Perth	77,367	2,335	33.13	28.12	31.92	31.88	472	19	24.84	24.76	29.44	25.44	100,819	14,319	7.04	5.55	6.30	6.49
Renfrew	14,752	354	41.67	40.15	40.04	43.59	185	5	37.00	36.00	36.00	39.00	25,548	3,254	7.85	7.24	6.11	7.42
Ross and Cromarty	23	1	23.00	23.42	25.67	27.33	724	28	25.86	21.71	26.81	28.22	49,154	8,482	5.80	6.55	4.53	4.74
Roxburgh	5,214	168	31.04	33.03	31.54	31.91	1,480	47	31.49	24.96	27.56	27.00	9,285	1,469	6.32	5.78	5.11	5.49
Selkirk	..	..	..	..	..	..	384	12	32.00	24.00	25.00	25.00	1,068	218	4.90	5.18	4.51	4.36
Shetland	..	..	..	..	..	..	..	..	..	..	..	..	12,428	3,198	3.89	6.16	3.02	2.87
Stirling	96,657	3,055	31.64	28.96	30.03	30.79	189	7	27.00	22.04	24.37	24.05	27,678	3,360	8.24	5.60	5.69	7.12
Sutherland	40	2	20.00	—	20.00	24.00	206	9	22.89	—	21.57	20.44	9,584	1,738	5.51	5.00	4.83	3.64
Wigtown	6,704	227	29.53	27.96	29.60	28.95	35	1	35.00	26.33	34.12	30.00	8,109	1,603	5.06	6.98	4.83	5.66
Total	453,566	13,965	32.48	..	..	..	25,010	1009	24.79	..	..	..	881,586	137,244	6.42	..	..	..

* As computed from Returns furnished by Estimators in 1885.

† Produce picked green.

TABLE No. 4.—ESTIMATED TOTAL PRODUCE of TURNIPS and MANGELS in the Year 1893, ACREAGE, Estimated Average YIELD per Acre, Estimated Ordinary Average YIELD, and Estimated Average YIELD per Acre in 1892 and 1891, in each of the COUNTIES of SCOTLAND.

COUNTIES.	TURNIPS.						MANGELS.					
	Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.				Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.			
			1893.	Ordinary Average.*	1892.	1891.			1893.	Ordinary Average.*	1892.	1891.
	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.
Aberdeen	1,496,854	91,283	16.40	15.13	15.22	12.93	65	5	13.00	14.00	8.00	9.11
Argyle	83,567	5,479	15.25	15.23	13.02	14.61	377	29	13.00	15.49	12.56	14.98
Ayr	179,298	7,736	23.18	16.61	15.36	19.37	10,535	433	24.33	16.32	14.25	17.70
Banff	380,174	22,695	16.75	14.58	16.26	9.14	60	4	15.00	—	10.00	8.00
Berwick	440,080	27,929	15.76	17.06	15.69	17.77	1,419	68	20.87	21.02	17.46	19.58
Bute	28,705	1,490	19.27	10.55	15.08	16.68	77	5	15.40	6.50	13.17	15.20
Caithness	281,892	13,982	20.16	15.83	21.42	7.27	32	3	10.67	..	..	..
Clackmannan	11,258	800	13.97	14.54	11.25	13.01	39	3	13.00	10.50	12.00	12.50
Dumbarton	33,530	1,559	21.51	10.96	15.05	17.01	424	22	19.27	7.11	13.60	14.58
Dumfries	364,181	21,009	18.20	17.13	12.32	14.14	1,202	51	23.57	24.93	18.00	26.41
Edinburgh	262,948	12,459	21.11	14.92	16.51	18.94	368	20	18.40	16.00	12.75	12.08
Elgin or Moray	304,087	16,036	18.96	15.94	16.07	10.97	55	3	18.33	19.89	16.00	10.00
Fife	339,948	26,259	12.95	13.44	10.70	11.89	68	8	8.50	10.00	20.06	8.86
Forfar	509,590	34,895	17.18	17.41	16.59	15.57	228	11	20.73	17.13	20.00	22.33
Haddington	317,810	16,183	19.64	17.49	18.88	19.48	379	25	15.16	15.31	12.11	12.55
Inverness	139,001	10,988	12.66	14.82	11.57	10.37	17	1	17.00	23.50	14.50	20.00
Kincardine	285,540	17,877	15.97	14.37	15.89	14.14	..	..	..	..	..	..
Kinross	41,197	2,726	15.11	13.54	9.09	12.85	..	..	..	..	..	..
Kirkcudbright	233,881	13,627	17.16	17.92	15.10	17.50	515	30	17.17	20.76	14.99	14.60
Lanark	201,789	9,327	21.63	17.07	16.42	19.71	299	17	17.59	13.06	10.16	13.92
Linlithgow	88,026	4,226	20.83	15.29	14.55	16.46	68	5	13.60	11.00	9.33	10.20
Nairn	62,828	4,237	14.83	14.41	14.08	10.25	..	..	..	18.00	10.00	..
Orkney	164,359	14,358	11.45	16.81	12.14	6.91	..	..	..	—	3.40	1.00
Peebles	83,848	4,196	19.98	16.16	14.93	16.52	14	1	14.00	..	..	..
Perth	482,080	29,835	16.16	16.78	13.83	14.30	154	13	11.85	12.00	10.53	10.35
Renfrew	52,264	2,444	21.38	17.67	14.51	16.30	499	33	15.12	15.07	12.96	15 47
Ross and Cromarty	198,947	16,349	12.17	14.91	11.09	10.32	128	7	18.29	24.18	21.93	22.20
Roxburgh	390,518	22,779	17.14	16.23	16.43	18.37	1,684	65	25.91	23.91	21.50	24.00
Selkirk	43,786	2,949	14.85	15.93	14.08	18.15	..	..	..	—	22.00	25.00
Shetland	18,314	1,290	14.20	13.75	10.95	6.19	..	..	..	..	..	..
Stirling	88,270	4,535	19.46	14.55	14.08	17.80	165	10	16.50	11.33	12.92	13.00
Sutherland	34,924	3,044	11.47	17.30	10.50	8.42	..	..	..	—	18.00	..
Wigtown	250,108	16,173	15.46	19.91	13.37	13.90	1,697	110	15.43	22.73	13.98	14.55
Total	7,983,651	479,755	16.64	..	..	..	20,568	982	20.95	..	..	..

* As computed from Returns furnished by Estimators in 1885.

TABLE No. 5.—ESTIMATED TOTAL PRODUCE OF HAY from Clover, Sainfoin, and Grasses under Rotation, also Total from Permanent Pasture, in the Year 1893, ACREAGE, Estimated Average YIELD per Acre, Estimated Ordinary Average YIELD, and Estimated YIELD per Acre in 1892 and 1891 in each of the COUNTIES of SCOTLAND.

COUNTIES.	FROM CLOVER, SAINFOIN, AND GRASSES.						FROM PERMANENT PASTURE.					
	Total Produce in 1893.	Acreage in 1893.	Average Yield per Acre.				Total Produce in 1893.	Acreage in 1893.†	Average Yield per Acre.			
			1893.	Ordinary Average.*	1892.	1891.			1893.	Ordinary Average.*	1892.	1891.
	Cwt.	Acres.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Acres.	Cwt.	Cwt.	Cwt.	Cwt.
Aberdeen	1,057,093	45,019	23.48	29.18	27.28	23.14	73,090	3,391	21.55	22.61	21.25	19.16
Argyle	297,225	10,246	29.01	30.79	33.65	23.59	391,086	13,801	28.34	26.35	31.29	24.16
Ayr	960,028	27,452	34.97	30.62	35.84	24.96	794,645	21,195	37.49	35.00	40.36	26.09
Banff	266,547	10,784	24.72	28.32	26.34	25.77	16,379	832	19.69	19.80	19.04	19.30
Berwick	253,100	9,177	27.58	39.01	36.72	31.08	71,278	2,936	24.28	35.04	30.02	30.66
Bute	67,058	2,032	33.00	33.41	38.01	31.05	22,401	778	28.79	34.33	29.56	22.16
Caithness	178,480	10,094	17.68	32.60	29.78	27.00	19,811	1,491	13.29	—	13.14	15.55
Clackmannan	45,464	1,397	32.54	30.94	36.87	26.24	16,525	661	25.00	23 84	38.60	28.91
Dumbarton	239,987	6,326	37.94	34.05	29.58	26.47	95,378	2,441	39.07	26.88	29.29	26.96
Dumfries	396,343	17,487	22.67	34.99	25.52	15.88	402,899	18,396	21.90	41.00	24.22	17.01
Edinburgh	501,016	11,999	41 75	37.55	47.81	39.68	79,498	2,379	33.42	34.26	36.87	32.46
Elgin or Moray	143,285	6,616	21.66	28.71	26.47	23.16	11,130	667	16.69	20.00	20.61	18.51
Fife	605,571	25,446	23.80	31.49	28.39	26.41	146,395	6,529	22.42	28.21	25.18	24.88
Forfar	576,975	19,335	29.84	32.78	34.84	23.14	67,596	3,027	22.33	21.48	28.35	20.00
Haddington	347,547	9,576	36.29	37.84	47.06	40.40	27,297	940	29.04	32.67	38.20	31.32
Inverness	196,814	11,991	16.41	21.74	16.91	15.49	60,173	5,693	10.57	13.25	10.54	12.27
Kincardine	266,988	11,667	22.88	27.45	29.20	25.97	26,502	1,752	15.13	16.03	20.02	19.97
Kinross	58,787	2,427	24.22	31.86	28.85	23.90	28,916	1,198	24.14	29.83	28.18	20.76
Kirkcudbright	232,925	9,190	25.32	28 37	30.04	20.41	302,137	12,699	23.79	28.68	25.04	21.12
Lanark	1,177,649	30,098	39.13	31.27	39.41	28.50	528,687	13,440	39.34	37.94	38.44	33.96
Linlithgow	219,001	6,089	35.97	35.07	41.31	33.24	61,069	2,074	29.45	33.77	33.59	28.89
Nairn	32,867	1,735	18.94	27.92	17.88	18.38	7,850	464	16.92	20.00	13.92	14.68
Orkney	153,07	8,602	17.80	33.88	19.85	21.26	8,414	1,948	4.32	28.38	5.19	5.63
Peebles	59,317	2,101	28.23	28.77	33.06	27.74	63,632	2,192	29.03	34.18	31.76	28.02
Perth	874,161	28,798	30.35	33.88	35.61	27.36	347,492	14,653	23.71	21.13	27.36	23.06
Renfrew	511,617	11,820	43.28	33.55	39.45	29.55	361,548	7,263	49.78	45.89	47.44	37.94
Ross and Cromarty	273,130	13,871	19.69	27.96	20.80	15.57	33,697	3,505	9.61	14.48	10.71	10.69
Roxburgh	234,012	8,785	26.64	37.74	38.55	30.09	134,017	5,319	25.20	36.49	31.29	29.45
Selkirk	23,018	918	25.07	37.78	31.36	28.71	32,088	1,621	19.80	30.30	25.30	24.72
Shetland	14,158	617	22.95	40.00	28.56	32.84	15,818	1,490	10.62	20.00	13.66	19.78
Stirling	405,808	12,310	32.97	29.53	30.55	25.90	113,024	3,968	28.48	19.51	28.80	25.19
Sutherland	70,251	4,124	17.03	19.96	18.49	16.00	14,946	1,497	9.98	9.21	10.93	11.36
Wigtown	148,027	4,000	37.01	38.21	46.11	28.39	105,175	4,313	24.39	32.78	32.34	23.14
Total	10,887,325	382,138	28.49	..	..	..	4,480,593	164,553	27.23	..	..	..

* As computed from Returns furnished by Estimators in 1886.

† Exclusive of mountain and heath land.

TABLE No. 6.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS IN EACH COUNTY OF SCOTLAND AS RETURNED ON JUNE 5, 1893.

COUNTIES.	HORSES (including Ponies).				CATTLE.				SHEEP.			PIGS.
	Used solely for Agriculture, &c.	Unbroken Horses.	Mares kept solely for breeding.	Total.	Cows and Heifers in Milk or in Calf.	Other Cattle. 2 Years and above.	Other Cattle. Under 2 Years.	Total.	1 Year Old and above.	Under 1 Year.	Total.	
1. Aberdeen	22,146	7,736	334	30,216	45,690	45,074	88,540	180,204	144,185	70,240	214,425	7,547
2. Argyle	4,399	2,351	267	7,017	22,760	15,269	24,321	62,350	720,366	330,304	1,050,670	3,767
3. Ayr	6,704	2,318	457	9,479	49,507	15,612	32,421	97,540	218,777	138,835	357,612	13,484
4. Banff	6,256	2,233	60	8,549	13,435	6,766	24,880	45,081	44,108	28,920	73,028	2,206
5. Berwick	4,283	1,257	216	5,756	3,256	5,349	9,120	17,725	160,700	139,816	300,516	3,060
6. Bute	945	399	48	1,392	3,782	1,951	4,058	9,791	33,920	17,887	51,807	664
7. Caithness	4,348	1,125	80	5,553	8,250	3,119	11,932	23,301	73,617	40,245	113,862	1,395
8. Clackmannan	477	183	6	666	1,772	990	1,430	4,192	8,244	4,963	13,207	2,286
9. Dumbarton	1,356	571	72	1,999	8,074	3,073	3,652	14,799	49,338	25,675	75,013	1,104
10. Dumfries	5,529	2,221	247	7,997	19,265	13,306	25,974	58,545	312,523	195,211	507,734	9,300
11. Edinburgh	3,587	776	83	4,446	11,782	4,104	4,400	20,286	109,204	74,506	183,710	5,854
12. Elgin	3,793	1,307	59	5,159	6,722	4,051	12,957	23,730	40,837	23,071	63,908	2,129
13. Fife	7,814	2,417	169	10,400	11,591	18,630	20,858	51,079	58,210	40,173	98,383	4,622
14. Forfar	8,465	1,975	103	10,543	12,329	19,921	20,146	52,396	101,186	56,294	157,480	6,073
15. Haddington	3,203	415	57	3,675	1,891	4,061	3,224	9,176	76,458	53,465	129,923	1,589
16. Inverness	6,826	2,183	138	9,147	22,206	7,505	24,160	53,871	463,521	209,041	672,562	2,752
17. Kincardine	3,954	1,212	61	5,227	7,256	6,567	13,728	27,551	23,913	13,736	37,649	1,941
18. Kinross	749	341	11	1,101	1,318	1,719	4,042	7,079	21,024	15,086	36,110	354
19. Kirkcudbright	3,870	1,951	240	6,061	16,859	14,861	18,959	49,679	244,707	132,555	377,262	6,237
20. Lanark	5,970	2,176	300	8,446	38,766	12,238	21,188	72,192	149,437	86,032	235,469	5,784
21. Linlithgow	1,542	643	71	2,256	4,649	3,180	3,817	11,646	18,327	9,492	27,819	1,266
22. Nairn	958	361	28	1,347	2,055	917	4,252	7,224	14,173	4,767	18,940	628
23. Orkney	4,777	1,309	67	6,153	9,781	3,683	14,023	27,487	18,299	15,340	33,639	2,836
24. Shetland	776	2,319	2,190	5,285	7,780	4,874	6,307	18,961	60,017	39,015	99,032	2,882
25. Peebles	891	249	25	1,165	2,081	1,507	3,343	6,931	109,554	77,116	186,670	598
26. Perth	9,954	3,218	271	13,443	18,667	22,871	36,522	78,060	500,041	237,109	737,150	6,878
27. Renfrew	2,437	882	177	3,496	16,301	3,792	5,833	25,926	23,211	13,993	37,204	1,150
28. Ross and Cromarty	6,007	1,691	109	7,807	18,562	8,431	18,815	45,808	224,596	109,182	333,778	4,548
29. Roxburgh	3,659	605	127	4,391	4,857	5,111	7,936	17,904	281,731	225,838	507,569	3,191
30. Selkirk	582	110	13	705	1,364	744	1,458	3,566	100,555	76,520	177,075	394
31. Stirling	3,417	1,521	150	5,088	11,560	9,384	11,303	32,247	82,181	46,844	129,025	1,966
32. Sutherland	2,149	449	39	2,637	5,805	2,263	5,340	13,408	144,624	64,641	209,265	871
33. Wigtown	4,185	2,295	292	6,772	23,443	8,503	16,328	48,274	79,311	46,357	125,668	9,442
Total	146,008	50,799	6,567	203,374	432,916	279,826	505,267	1,218,009	4,710,895	2,662,269	7,373,164	119,398

TABLE No. 7.—QUANTITIES AND VALUES OF THE IMPORTS OF LIVE CATTLE, SHEEP, AND SWINE, 1891 AND 1892.

	QUANTITIES.		VALUES.	
	1891.	1892.	1891.	1892.
	No.	No.	£	£
Live cattle	507,407	502,237	8,581,574	9,224,011
Live sheep	344,504	79,048	663,015	125,659
Live pigs	542	3,826	1,809	12,465
Total	..	..	9,246,398	9,362,135

TABLE No. 8.—QUANTITIES AND VALUES OF THE IMPORTS OF BEEF, MUTTON, PORK, BACON, HAMS, FISH, EGGS, BUTTER, &c., 1891 AND 1892.

	QUANTITIES.		VALUES.	
	1891.	1892.	1891.	1892.
Meat—	Cwt.	Cwt.	£	£
Beef, fresh	1,920,511	2,079,637	4,038,495	4,413,148
Beef, salted	247,759	275,394	356,022	388,588
Beef, preserved otherwise	554,235	567,991	1,294,090	1,339,094
Mutton, fresh	1,662,994	1,699,966	3,282,001	3,447,102
Mutton, preserved	65,073	68,412	136,934	139,202
Pork, fresh	127,518	132,107	302,725	310,165
Pork, salted	226,798	228,354	295,932	306,262
Bacon	3,510,209	3,881,378	6,650,324	7,930,121
Hams	1,204,803	1,253,132	2,791,437	2,963,712
Unenumerated, salted or fresh	113,357	150,573	255,898	344,945
„ other than by salting	156,953	163,098	457,037	473,469
Total	9,790,210	10,500,042	19,860,895	22,055,808
Fish	2,355,370	2,550,617	2,809,949	2,760,000
Rabbits	103,685	107,630	286,981	303,262
Poultry and game (see value)	..	..	456,979	583,430
Butter	2,135,607	2,183,009	11,591,183	11,965,190
Margarine	1,235,430	1,305,350	3,558,203	3,712,884
Cheese	2,041,325	2,232,817	4,813,404	5,416,784
Lard	1,051,284	1,239,051	1,720,051	2,223,011
Eggs . . . Thousands	1,275,397	1,336,730	3,505,522	3,794,718
Total	..	..	28,742,272	31,689,567

TABLE No. 9.—QUANTITIES AND VALUES OF THE IMPORTS OF WHEAT AND WHEAT-FLOUR, 1891 AND 1892.

	QUANTITIES.		VALUES.	
	1891.	1892.	1891.	1892.
	Cwt.	Cwt.	£	£
Wheat	66,312,962	64,901,799	29,448,204	24,857,902
Wheat-flour	16,725,003	22,106,009	10,184,887	12,267,453
Total	..	..	39,633,091	37,125,355

TABLE No. 10.—QUANTITIES AND VALUES OF THE IMPORTS OF BARLEY, OATS, INDIAN CORN, RYE, MEAL, &c., 1891 AND 1892.

	QUANTITIES.		VALUES.	
	1891.	1892.	1891.	1892.
	Cwt.	Cwt.	£	£
Barley	17,465,698	14,277,342	5,941,899	4,313,962
Oats	16,600,394	15,661,394	5,471,279	5,013,545
Maize	26,825,625	35,381,224	8,411,763	9,425,311
Peas	2,419,381	2,501,492	862,427	883,235
Beans	3,672,413	4,429,933	1,206,916	1,365,221
Rye	466,284	574,891	167,749	192,234
Buckwheat	177,892	131,142	59,179	40,696
Total	..	..	22,121,212	21,214,044
Oatmeal	171,711	414,866	100,843	226,510
Other meals	476,638	537,035	167,263	167,183
Total	..	..	268,106	393,693

TABLE No. 11.—AVERAGE PRICES PER HEAD OF VARIOUS KINDS OF ANIMALS, DEAD MEAT, AND PROVISIONS IMPORTED INTO THE UNITED KINGDOM IN 1891 AND 1892.

Kind of Animals, Dead Meat, &c.		1891.	1892.
Animals—Horses	each	£19 18 11	£20 5 3
" Oxen and bulls from all countries	"	18 7 5	18 9 8
" Sheep, including lambs, from all countries	"	1 18 6	1 11 10
" Pigs	"	3 6 9	3 5 2
Bacon—From all countries	per cwt.	1 17 11	2 0 10
Hams—From all countries	"	2 6 4	2 7 4
Beef, salted—From all countries	"	1 8 8	1 8 3
" fresh—From all countries	"	2 2 1	2 2 5
Pork, salted—From all countries	"	1 6 1	1 6 10
" fresh—From all countries	"	2 7 6	2 6 11
Butter—From all countries	"	5 8 7	5 9 8
Margarine	"	2 17 7	2 16 11
Cheese—From all countries	"	2 7 2	2 8 6
Potatoes—From all countries	"	0 7 6	0 6 4
Eggs—From all countries	per 120	0 6 7	0 6 10
Lard—From all countries	per cwt.	1 12 9	1 15 10

TABLE No. 12.—RETURN OF THE AVERAGE PRICES OF WOOL IN THE YEARS 1891 AND 1892.

Years.	Australian.	South African.	English Fleeces.
	Per lb.	Per lb.	Per lb.
	s. d.	s. d.	s. d. s. d.
1891	0 9¾	0 9¾	0 9½ to 1 2
1892	0 9	0 9½	0 8½ " 1 2

[EDINBURGH

EDINBURGH CORN-MARKET GRAIN TABLES for WHEAT, BARLEY, OATS, and BEANS, showing the Quantity offered for Sale, the Quantity Sold, the Highest, Lowest, and Average Prices, also the Bushel-weights of the Highest and Lowest Prices of each kind of Grain for every Market-day, likewise the Results for every Month, and the final Result for the year 1893.

WHEAT.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1893 Jan.	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb.	lb.	lb.	lb.
4	375	345	28 6	20 0	25 3		62½		60
11	512	452	28 6	20 0	25 2		63¼		56¾
18	742	673	29 0	22 6	25 11		63		58
25	722	357	31 0	21 0	26 3		63		59¼
	2,351	1,827	29 8	21 4	25 8				
Feb. 1	684	519	29 0	23 6	25 10		63	60	63
8	283	203	29 0	24 6	26 3		63		60½
15	448	392	30 0	22 0	26 6		63½		58½
22	690	540	29 6	20 0	25 5		63	55	63
	2,105	1,654	29 3	23 1	25 11				
March 1	800	623	28 0	22 6	26 2	63	63¾		59½
8	953	639	27 0	19 0	24 3		63½		56½
15	706	492	27 0	20 0	25 4		62¾		58½
22	540	371	25 0	20 0	22 10	61½	63		61
29	268	248	27 6	18 0	24 3		63		58½
	3,267	2,373	26 11	20 9	24 9				
April 5	258	258	27 3	19 6	24 1		63		58½
12	322	272	28 0	24 0	26 11	62	63	60	61
19	589	549	28 0	24 0	26 4	62¾	63		60½
26	926	789	27 9	21 6	26 0		63		60
	2,095	1,868	27 11	22 5	26 0				
May 3	1,273	1,027	29 0	22 3	26 5		64¾		59½
10	1,630	1,505	28 9	21 6	26 10		63		58½
17	1,010	740	29 0	21 6	26 3		63		60½
24	1,371	938	28 0	16 0	25 6		63		55¾
31	1,450	922	28 0	20 0	25 3		63½		61
	6,734	5,132	28 8	21 3	26 2				
June 7	1,175	1,054	28 0	18 6	24 7		65½		59¼
14	1,422	1,145	27 3	20 0	25 3		63½		59½
21	917	762	26 6	21 6	25 6	62	64		62
28	1,301	604	27 0	21 0	25 9		63	56¾	57¾
	4,815	3,565	26 10	20 10	25 2				
July 5	992	792	27 0	18 6	25 5	63	64½		56
12	1,836	1,126	26 0	20 6	25 1	62	63½		61½
19	1,858	1,192	26 0	20 0	24 10		63½		59½
26	1,789	1,126	26 0	20 0	24 6		62¾		59
	6,475	4,236	26 3	19 10	24 11				

WHEAT—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.		Lowest Price.		Average Price.		Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1893	Imp. qr.	Imp. qr	s.	d.	s	d.	s.	d.	lb.	lb.	lb.	lb.
Aug.												
2	2,661	1,166	25	6	18	0	23	2		63½	60	62
9	1,939	1,639	25	3	20	6	23	7		63½		61
16	1,015	864	25	0	20	0	23	1	62	63¼	61	62
23	360	255	25	0	20	0	23	7	63	63½		60½
30	209	209	25	6	19	6	22	8		63		58½
	6,184	4,133	25	3	19	4	23	4				
Sept.												
6	560	400	26	0	16	0	23	6		64½		61
13	1,051	477	27	0	19	0	24	0		63¾		60
20	1,392	963	31	0	20	0	24	5		64½		60¼
27	832	446	35	0	21	0	25	9		64½		59½
	3,835	2,286	29	0	19	0	24	5				
Oct.												
4	1,453	711	40	0	21	0	26	1		63		60
11	1,109	740	35	0	19	0	27	10		63		58¼
18	1,121	455	40	0	20	0	27	0		63		58½
25	1,021	355	40	0	24	0	26	10		63	62	63
	4,704	2,261	38	1	22	10	27	0				
Nov.												
1	788	375	32	0	22	6	25	7		64½		61½
8	770	676	31	6	22	6	25	6		64½		62
15	463	179	28	0	23	0	25	1		65		63
22	349	288	27	0	24	0	25	0		63		61½
29	311	215	27	0	22	3	25	6		63½		61¼
	2,681	1,733	27	10	23	3	25	5				
Dec.												
6	277	257	27	0	23	6	25	3		64		61
13	359	324	27	6	24	0	26	1		63		60¼
20	533	533	27	6	25	6	26	4	62	64¼		62
27	287	242	27	0	23	0	26	1	63	64		59½
	1,456	1,356	27	3	24	2	26	0				
Result for year	46,702	32,424	27	3	21	5	25	3				

BARLEY.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.		Lowest Price.		Average Price.		Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1893												
Jan.												
4	1,595	760	29	6	20	0	25	11		56½		54½
11	2,278	1,125	30	0	20	0	26	5		56	52	54¼
18	3,279	1,071	30	6	19	9	25	6		58		58
25	2,676	1,317	29	6	19	0	25	1		57	54	55
	9,828	4,273	29	10	19	7	25	8				
Feb.												
1	1,866	581	30	6	19	0	25	1		57½		55½
8	1,538	834	30	0	18	0	24	10		57¼		54½
15	1,428	822	30	0	19	6	25	1		56		54
22	2,034	999	29	0	17	0	25	2		57		53
	6,866	3,236	29	10	18	8	25	0				

BARLEY—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1898 March	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb.	lb.	lb.	lb.
1	2,577	953	29 0	18 0	24 3		57½		53
8	2,078	752	28 0	15 6	23 4		56		52
15	1,420	864	27 6	18 6	23 10	56½	57		53
22	1,040	575	29 0	19 0	24 0		57		52¼
29	843	604	28 0	19 0	24 8		56½		53
	7,958	3,748	28 2	18 4	24 0				
April									
5	407	283	27 6	18 0	24 0		56		53½
12	906	630	27 9	19 6	24 3		57		56
19	470	281	27 6	22 0	25 5	56½	57	53	53¼
26	596	393	27 6	22 0	23 7		57	53¼	55
	2,379	1,587	27 7	21 0	24 3				
May									
3	972	332	27 6	22 0	25 10	57	57½	53¼	56
10	523	225	25 0	21 6	24 1		56		55½
17	380	171	27 6	21 3	25 4		56½		55
24	334	249	26 6	19 0	23 10		55¾		56
31	78	38	24 0	21 6	22 11		55½		56
	2,287	1,015	27 3	20 10	24 9				
June									
7	113	89	26 6	21 0	23 5		56½		53¼
14	254	20	21 6	..	21 6		55½		..
21	70	50	24 0	21 6	22 9		56		56
28	130	95	26 0	20 0	22 5		55¼		55
	567	254	24 6	21 0	22 9				
July									
5	15	15	23 0	..	23 0		56		..
12	63	63	25 6	21 6	24 8		56		53½
19	146	96	25 6	20 6	23 0		56		52
26	159	97	26 0	20 0	23 10		57¼		53¼
	383	271	25 3	20 9	23 8				
Aug.									
2	284	264	26 6	20 6	24 3		57½		52
9	386	271	27 0	23 9	25 8		55¾		56
16	305	76	26 0	23 6	25 6	55	56		55
23	578	222	28 6	21 0	26 4		57½		53¼
30	1,917	1,697	31 0	23 3	27 1		60	56½	57
	3,470	2,530	27 9	23 0	26 6				
Sept.									
6	1,599	1,452	30 0	22 0	27 11	56	59		56
13	1,530	1,050	31 0	23 3	28 0		56		54
20	2,043	1,586	30 6	22 0	27 6		57		54¼
27	1,968	1,503	31 9	22 0	28 8		56		52
	7,140	5,591	30 8	22 3	28 0				
Oct.									
4	1,818	1,548	31 0	23 0	29 1	56¾	57¼		52
11	2,532	2,203	32 6	22 6	29 2		57		56
18	1,931	1,581	32 0	22 6	29 10		58½		56
25	2,935	1,850	32 0	25 0	29 2		57		54¼
	9,211	7,182	31 7	22 11	29 4				

BARLEY—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1893	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb. lb.	lb. lb.
Nov.							
1	2,861	1,361	31 0	22 6	29 1	56 57½	53½
8	2,163	1,838	31 6	23 6	29 4	57	52
15	2,245	1,699	32 3	21 6	29 5	57	54½
22	2,211	1,699	32 9	20 0	30 5	56½	46½
29	1,944	1,453	32 9	23 6	30 10	56¾ 57¼	53¼
	11,424	8,050	31 11	22 1	29 10		
Dec.							
6	2,232	1,771	32 6	23 0	30 10	56½ 57¼	54½
13	1,288	939	32 9	26 0	31 4	57¼	56
20	1,891	1,522	33 6	25 0	31 1	57½	55
27	1,829	792	33 3	27 0	31 1	58	55
	7,240	5,024	32 10	25 8	31 1		
Result for year	68,753	42,761	30 1	21 3	27 9		

OATS.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1893							
Jan.							
4	2,768	2,187	27 0	14 0	21 5	46¼	37½
11	3,913	3,033	27 0	15 0	21 5	45½	37½ 40
18	4,548	3,178	28 0	16 0	22 1	44½	39¼
25	3,710	2,974	28 9	14 6	22 8	44½	35¾
	14,939	11,372	27 8	14 11	21 11		
Feb.							
1	3,634	2,459	28 6	16 0	23 4	44½	36½ 36¾
8	3,971	2,616	30 0	15 9	23 11	46	36½ 39
15	5,514	2,113	31 0	8 0	24 9	45½	32¾
22	7,001	1,660	32 0	16 0	23 9	45½	41
	20,120	8,848	29 11	14 5	23 11		
March							
1	5,581	1,891	31 0	15 6	23 2	45½	38
8	6,082	2,522	31 0	17 6	24 1	45½	39¾
15	5,441	2,363	30 0	16 0	24 0	44 45½	39¼
22	4,534	2,329	30 0	18 6	23 11	44 44½	41
29	3,212	1,733	30 0	18 0	24 0	45	41
	24,850	10,838	30 0	16 7	23 10		
April							
5	2,779	1,607	28 6	18 9	24 3	44½ 46	42
12	2,485	1,590	29 0	18 0	24 6	44½ 46	37½
19	2,955	1,516	30 0	19 0	25 5	45¼	40
26	3,251	1,528	29 3	17 6	24 10	46	39¼
	11,470	6,241	29 1	18 3	24 9		
May							
3	2,770	1,204	28 6	19 0	25 6	45¼	39¼
10	2,955	1,473	29 0	18 6	24 8	44½	40 40½
17	2,776	1,117	29 6	20 6	25 2	45¾	42
24	2,674	855	27 9	18 6	24 1	45	37½
31	1,840	967	27 0	20 0	24 2	44½ 45½	40½ 41
	13,015	5,616	27 10	19 5	24 9		

OATS—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1898	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb.	lb.	lb.	lb.
June 7	1,759	1,094	28 6	19 0	24 11		46¾		40
14	1,578	1,174	28 0	20 0	25 6	44½	45½		42
21	1,343	814	30 0	19 0	25 11		46¾		42
28	1,899	1,178	30 0	21 9	26 4	44½	45½		40
	6,579	4,260	28 8	20 2	25 8				
July 5	2,603	1,202	30 6	22 0	26 8		46		40
12	2,938	1,096	30 6	15 0	27 3		45¼		39
19	2,516	515	29 0	23 6	26 6	44	45¾		42
26	2,601	870	28 0	21 6	25 10	45¼	45½		42
	10,658	3,683	29 0	19 3	26 7				
Aug. 2	2,556	897	28 6	21 0	25 10		45½		44
9	1,618	753	27 0	21 0	24 9		45½		42
16	1,882	1,246	29 0	18 0	25 3		45½		41
23	2,174	1,526	27 0	21 6	24 3		44		42
30	2,412	1,567	25 6	20 0	22 5		45½		42
	10,642	5,989	27 10	21 2	24 3				
Sept. 6	2,452	1,743	23 6	18 6	21 4	46	46¼	39	42½
13	2,584	2,064	25 6	18 6	20 6		44		41
20	1,993	1,690	26 0	17 0	20 4		42¾		40
27	1,749	1,129	23 0	16 6	20 6		42		37½
	8,778	6,626	24 0	18 2	20 8				
Oct. 4	1,705	1,553	23 0	18 6	20 8		43	41	42½
11	1,894	1,607	26 6	19 6	21 11		45½	41	42
18	2,194	1,628	27 0	18 0	22 1		43½		39¼
25	3,686	2,479	24 0	18 6	21 4		45	38½	39
	9,479	7,267	25 2	18 10	21 6				
Nov. 1	2,670	2,072	23 0	18 0	21 4		45½		40
8	2,482	1,804	22 9	18 0	21 2		45		37½
15	3,079	2,220	22 6	18 0	21 1		45½		40½
22	3,842	2,499	23 0	16 0	20 7		46¼		38
29	3,466	2,400	25 0	17 9	20 1		45½		38½
	15,539	10,995	22 11	17 10	20 10				
Dec. 6	3,469	2,081	25 0	18 0	20 3		45¼	41	42
13	2,937	2,323	22 0	16 0	19 9		45¾		39½
20	3,031	2,543	23 6	17 0	20 1		45½		40
27	2,564	1,927	21 6	16 0	19 10	44½	45¼		..
	12,001	8,874	22 0	17 6	19 11				
Result for year	158,070	90,609	27 0	18 4	22 9				

BEANS.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1893	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb. lb.	lb. lb.
Jan.							
4	20	..	..	..	..	..	..
11	64	29	33 6	30 6	31 5	65½	65
18	44	14	30 6	30 0	30 2	63½	63½
25	28	28	32 6	29 6	31 6	64	63
	156	71	32 6	30 2	31 3		
Feb.							
1	164	72	35 0	27 6	31 2	64	62
8	337	109	40 0	27 0	33 8	64 64½	63½
15	303	194	40 0	27 6	31 8	64	63
22	347	195	38 0	29 0	33 4	63	58½
	1,151	570	38 6	27 9	32 7		
March							
1	215	90	35 0	30 0	32 11	64	60¼
8	279	138	36 6	28 0	33 2	63¾	62
15	406	244	36 0	28 0	31 10	63½ 64	62
22	163	101	36 6	30 9	32 8	63¾	60
29	125	31	34 0	23 0	27 3	..	..
	1,188	604	35 5	28 0	32 2		
April							
5	81	35	32 6	26 0	31 4	62 63	56½
12	55	11	32 9	..	32 9	62¾	..
19	35	15	33 6	31 0	32 8	64	62
26	61	..	..	..	..	..	..
	232	61	32 10	28 3	31 11		
May							
3	103	29	32 3	31 3	31 9	63	63
10	140	37	33 6	29 6	31 8	63	63
17	125	..	..	..	..	..	..
24	75	13	30 6	28 6	29 0	63	62
31	65	48	30 0	28 0	28 9	62	59½
	508	127	31 10	29 1	30 4		
June							
7	22	..	..	..	..	..	..
14	22	22	29 6	..	29 6	63	..
21	..	..	..	..	..	..	..
28	26	17	28 0	..	28 0	56¾	..
	70	39	28 10	..	28 10		
July							
5	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..
19	5	5	27 0	..	27 0	60	..
26	20	..	..	..	..	..	..
	25	5	27 0	..	27 0		
Aug.							
2	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..
16	10	..	..	..	..	..	..
23	24	5	33 0	..	33 0	63	..
30	13	13	27 0	..	27 0	62	..
	47	18	28 8	..	28 8		

BEANS—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1893 Sept.	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb. lb.	lb. lb.
6	..	..	..	..	..	..	..
13	10	..	..	..	..	..	..
20	20	5	33 0	..	33 0	65½	..
27	37	..	..	..	..	..	..
	67	5	33 0	..	33 0		
Oct. 4	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..
	..	..	..	..	..		
Nov. 1	47	47	34 0	33 0	33 2	64	66½
8	46	..	..	..	..	..	..
15	22	10	33 0	..	33 0	64	..
22	12	12	33 6	33 0	33 3	64	64
29	47	40	31 0	..	31 0	64	..
	174	109	31 10	33 0	32 4		
Dec. 6	98	40	31 0	30 0	30 9	64¼	65½
13	47	12	29 0	..	29 0	64	..
20	10	6	31 0	..	31 0	64½	..
27	..	..	..	..	..	..	..
	155	58	30 6	30 0	30 5		
Result for year	3,773	1,667	32 9	29 4	31 11		

PRICES OF SHEEP SINCE 1818. TABLE No. 1.—CHEVIOT SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
1818	28	0	to	30	0	not quoted.					8	0	to	10	0
1819	25	0	"	27	0	15	0	to	17	0	10	6	"	12	0
1820	20	0	"	25	0	16	0	"	17	0	10	0	"	11	0
1821	18	0	"	20	0	14	0	"	16	0	7	6	"	8	0
1822	12	6	"	13	0	8	0	"	8	6	4	6	"	0	0
1823	13	6	"	18	0	7	0	"	10	6	5	6	"	6	0
1824	14	0	"	19	0	7	0	"	9	0	4	6	"	6	0
1825	29	0	"	32	0	15	0	"	19	0	9	0	"	10	6
1826	17	6	"	21	6	13	0	"	15	0	7	0	"	7	6
1827	15	0	"	24	0	not quoted.					7	0	"	8	0
1828	18	0	"	27	6	12	0	to	15	0	7	0	"	8	3
1829	18	0	"	24	0	12	6	"	14	0	7	0	"	8	6
1830	15	0	"	21	0	8	0	"	11	0	6	0	"	6	9
1831	18	0	"	25	0	9	0	"	13	0	7	0	"	8	0
1832	19	0	"	24	0	11	0	"	16	0	7	0	"	9	0
1833	22	0	"	31	0	13	6	"	20	0	8	0	"	11	3
1834	22	0	"	31	0	13	6	"	21	0	9	0	"	11	6
1835	22	0	"	27	6	18	0	"	20	6	8	0	"	11	0
1836	24	0	"	31	6	16	0	"	19	0	10	0	"	14	0
1837	19	0	"	28	0	14	0	"	19	0	10	0	"	13	0
1838	23	0	"	30	6	17	0	"	22	0	12	0	"	14	0
1839	23	0	"	31	0	14	0	"	19	0	0	0	"	13	0
1840	24	0	"	33	0	15	0	"	23	0	7	0	"	11	6
1841	23	0	"	30	0	14	0	"	22	0	8	0	"	12	0
1842	22	6	"	28	0	13	0	"	17	0	7	6	"	10	0
1843	19	0	"	25	0	8	0	"	12	0	5	0	"	8	0
1844	21	0	"	59	0	10	0	"	16	0	8	0	"	10	6
1845	23	0	"	33	0	13	0	"	20	0	8	0	"	13	0
1846	24	0	"	33	6	14	6	"	21	6	10	0	"	14	6
1847	24	0	"	35	0	13	0	"	24	0	11	6	"	15	0
1848	23	0	"	34	6	13	0	"	28	0	11	6	"	15	0
1849	21	0	"	30	2	12	0	"	21	0	0	0	"	14	0
1850	20	6	"	29	6	12	0	"	20	0	8	0	"	13	0
1851	21	6	"	31	0	13	0	"	21	0	8	9	"	14	0
1852	21	0	"	32	0	15	0	"	23	0	8	0	"	14	0
1853	26	6	"	38	0	17	0	"	28	6	9	0	"	17	0
1854	25	0	"	36	0	17	0	"	26	0	9	0	"	16	6
1855	23	6	"	36	0	16	0	"	25	0	10	0	"	17	0
1856	22	0	"	35	6	15	6	"	24	0	10	0	"	15	0
1857	24	0	"	36	0	14	6	"	26	0	10	6	"	14	6
1858	24	0	"	34	6	14	0	"	24	6	10	6	"	14	0
1859	25	0	"	34	6	16	0	"	25	0	10	3	"	14	9
1860	26	0	"	38	0	17	6	"	27	6	12	6	"	17	6
1861	25	0	"	38	6	16	0	"	28	0	9	0	"	16	0
18[illegible]	27	0	"	37	6	17	6	"	28	0	10	0	"	16	0
1863	25	0	"	38	6	19	0	"	28	6	10	6	"	16	0
1864	31	0	"	41	0	21	0	"	31	6	14	0	"	18	0
1865	32	6	"	44	0	22	6	"	33	6	14	6	"	20	0
1866	37	0	"	50	0	29	0	"	42	6	15	0	"	26	0
1867	26	0	"	58	0	18	0	"	25	6	12	0	"	16	0
1868	30	0	"	32	0	15	6	"	21	0	7	6	"	13	0
1869	28	0	"	38	0	15	0	"	22	6	7	6	"	14	0
1870	35	6	"	43	0	18	0	"	28	0	10	0	"	17	0
1871	36	6	"	40	0	22	0	"	33	6	14	0	"	20	0
1872	45	0	"	56	0	32	0	"	42	0	16	0	"	22	0
1873	42	0	"	51	0	25	0	"	42	0	15	6	"	22	0
1874	33	6	"	44	6	21	0	"	36	0	12	0	"	17	0
1875	33	0	"	48	6	21	0	"	34	0	13	6	"	23	6
1876	40	0	"	52	6	23	0	"	30	0	13	6	"	25	0
1877	41	0	"	51	0	25	0	"	37	0	15	0	"	24	0
1878	35	6	"	48	0	23	6	"	35	0	14	0	"	22	0
1879	34	0	"	44	0	21	0	"	34	0	14	0	"	20	0
1880	30	0	"	43	6	20	0	"	30	0	12	6	"	20	0
1881	32	0	"	45	6	29	0	"	34	0	14	0	"	20	0
1882	40	0	"	51	0	30	0	"	40	0	14	0	"	20	6
1883	44	0	"	55	6	34	6	"	46	6	15	6	"	23	0
1884	36	0	"	47	6	29	6	"	41	6	12	6	"	20	0
1885	30	0	"	38	0	24	0	"	31	0	12	0	"	18	0
1886	32	0	"	40	0	21	0	"	29	0	12	6	"	19	0
1887	29	0	"	36	0	18	0	"	26	0	11	0	"	16	6
1888	30	0	"	38	0	19	0	"	27	0	12	0	"	17	6
1889	36	0	"	44	0	24	0	"	32	0	14	0	"	22	0
1890	31	0	"	40	0	22	0	"	30	0	12	6	"	20	0
1891	27	0	"	38	0	16	0	"	25	0	9	0	"	16	0
1892	22	0	"	30	6	13	0	"	22	0	5	0	"	11	0
1893	26	0	"	35	6	18	0	"	28	6	8	6	"	15	0

TABLE NO. 2.—BLACKFACED SHEEP.

Year.	Wethers.	Ewes.	Lambs.
	s. d. s. d.	s. d. s. d.	s. d. s. d.
1819	22 0 to 24 0	12 0 to 15 0	8 0 to 9 0
1820	20 0 " 23 3	15 6 " 17 0	7 0 " 8 6
1821	18 0 " 20 0	12 0 " 13 0	6 0 " 7 0
1822	11 6 " 13 6	5 6 " 6 0	4 6 " 0 0
1823	12 0 " 16 0	5 0 " 6 6	4 0 " 5 3
1824	9 6 " 13 6	6 0 " 7 0	4 0 " 5 0
1825	22 0 " 26 0	11 0 " 13 6	6 0 " 9 0
1826	15 0 " 17 0	8 0 " 9 0	4 6 " 6 0
1827	14 0 " 18 6	7 0 " 10 0	6 0 " 7 6
1828	15 0 " 20 0	8 0 " 11 0	5 0 " 7 6
1829	14 0 " 18 0	9 0 " 10 0	6 0 " 7 0
1830	9 6 " 13 0	4 0 " 6 0	4 6 " 6 0
1831	13 0 " 17 0	5 0 " 7 6	5 0 " 6 6
1832	14 0 " 18 0	7 0 " 11 6	6 0 " 7 8
1833	16 0 " 24 0	7 6 " 12 0	6 6 " 9 0
1834	16 0 " 22 0	10 0 " 13 0	6 0 " 8 6
1835	15 0 " 18 9	10 0 " 13 0	7 0 " 8 0
1836	15 0 " 21 0	9 0 " 12 0	8 6 " 11 0
1837	13 0 " 16 0	8 0 " 12 0	8 0 " 9 6
1838	15 0 " 20 6	10 0 " 13 0	not quoted.
1839	15 0 " 22 0	10 0 " 12 0	7 0 to 8 3
1840	15 0 " 22 6	11 0 " 12 0	7 0 " 9 3
1841	16 0 " 20 0	9 0 " 11 0	6 0 " 8 0
1842	14 0 " 19 0	7 6 " 8 0	5 6 " 7 0
1843	not quoted.	4 9 " 6 6	not quoted.
1844	15 0 to 21 0	6 6 " 10 0	5 0 to 8 0
1845	14 0 " 23 0	8 0 " 12 0	6 0 " 8 0
1846	13 0 " 24 0	10 0 " 13 0	8 0 " 9 0
1847	20 6 " 25 0	10 0 " 14 0	8 6 " 9 6
1848	20 0 " 24 0	11 3 " 12 0	8 6 " 10 0
1849	not quoted.	not quoted.	7 0 " 7 6
1850	..	..	7 0 " 0 0
1851	17 6 to 23 0	9 0 to 12 0	6 6 " 8 0
1852	18 6 " 22 0	9 6 " 12 0	4 6 " 7 9
1853	23 0 " 27 0	14 6 " 16 6	8 0 " 11 6
1854	20 0 " 26 0	11 0 " 16 6	8 0 " 10 6
1855	23 6 " 26 6	14 0 " 16 0	10 0 " 11 0
1856	17 0 " 24 0	10 0 " 20 0	7 6 " 10 0
1857	20 0 " 29 0	10 6 " 15 0	9 3 " 11 0
1858	20 0 " 27 6	9 9 " 18 9	8 3 " 10 6
1859	20 0 " 25 0	10 0 " 14 0	8 9 " 11 0
1860	21 0 " 27 8	11 0 " 16 0	10 0 " 13 6
1861	21 0 " 29 0	12 0 " 22 0	6 3 " 14 0
1862	16 9 " 27 0	12 0 " 18 8	6 0 " 12 0
1863	20 0 " 30 6	13 0 " 16 0	8 0 " 11 6
1864	25 0 " 30 0	15 0 " 19 0	10 0 " 13 6
1865	15 6 " 32 6	15 0 " 25 0	10 0 " 17 0
1866	31 6 " 40 0	20 0 " 36 0	13 6 " 22 6
1867	20 0 " 30 6	14 0 " 22 0	7 6 " 13 6
1868	20 0 " 26 0	10 6 " 13 6	7 0 " 13 0
1869	22 0 " 28 0	11 0 " 14 0	6 9 " 9 0
1870	27 0 " 32 6	13 0 " 22 0	8 0 " 14 6
1871	23 0 " 37 0	13 0 " 23 0	11 0 " 16 3
1872	31 6 " 45 0	18 0 " 32 0	12 6 " 18 0
1873	28 0 " 39 0	16 6 " 27 0	7 0 " 16 0
1874	25 0 " 35 0	13 0 " 20 0	7 0 " 14 0
1875	26 6 " 37 6	15 0 " 21 3	9 6 " 17 6
1876	30 0 " 40 0	19 0 " 24 0	13 0 " 20 6
1877	35 0 " 38 9	18 0 " 25 0	13 6 " 23 0
1878	30 0 " 36 0	17 0 " 23 0	12 0 " 22 0
1879	25 0 " 35 9	16 0 " 24 0	10 6 " 20 0
1880	25 0 " 38 0	16 6 " 22 6	10 0 " 17 0
1881	30 0 " 39 0	15 0 " 23 0	10 0 " 15 0
1882	33 0 " 46 0	20 0 " 28 0	12 6 " 18 6
1883	36 0 " 50 6	24 6 " 33 0	14 0 " 21 6
1884	29 0 " 43 6	19 6 " 28 0	12 0 " 19 6
1885	24 0 " 34 0	13 0 " 22 6	10 0 " 15 0
1886	25 0 " 34 0	12 0 " 22 0	10 6 " 16 0
1887	22 0 " 30 0	11 0 " 19 0	8 0 " 13 0
1888	22 0 " 32 0	13 0 " 24 0	10 0 " 15 0
1889	26 0 " 40 0	18 0 " 29 0	13 0 " 22 0
1890	24 0 " 37 0	14 0 " 27 0	10 6 " 19 0
1891	21 0 " 37 0	10 0 " 24 0	7 6 " 15 0
1892	16 0 " 28 6	6 0 " 17 0	3 0 " 10 0
1893	21 0 " 37 0	12 0 " 24 0	7 0 " 14 6

TABLE NO. 3.—PRICE OF WOOL, PER STONE OF 24 LB., SINCE 1818.

Year.	Laid Cheviot.	White Cheviot.	Laid Highland.	White Highland.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
1818	40 0 to 42 2	..	20 0 to 22 6	..
1819	21 0 " 22 0	..	10 0 " 10 3	..
1820	20 0 " 22 0	..	9 0 " 10 0	..
1821	18 0 " 20 0	..	9 0 " 10 0	..
1822	12 6 " 14 6	..	5 0 " 6 6	..
1823	9 0 " 10 6	..	5 0 " 5 9	..
1824	13 6 " 15 0	..	6 0 " 6 3	..
1825	10 6 " 22 0	..	10 0 " 10 6	..
1826	11 0 " 14 0	..	5 0 " 5 6	..
1827	11 0 " 14 0	..	5 6 " 6 9	..
1828	8 0 " 11 0	..	5 6 " 6 0	..
1829	8 6 " 11 0	..	4 3 " 0 0	..
1830	9 6 " 11 0	..	4 6 " 5 0	..
1831	17 0 " 20 0	..	7 6 " 8 6	..
1832	14 0 " 16 0	..	7 0 " 7 6	..
1833	18 0 " 20 7	..	10 0 " 11 0	..
1834	21 0 " 24 6	..	5 6 " 7 0	..
1835	19 0 " 20 6	..	9 6 " 10 8	..
1836	21 0 " 25 0	..	10 0 " 14 0	..
1837	12 0 " 14 0	..	7 0 " 7 8	..
1838	19 0 " 22 6	..	6 0 " 10 0	..
1839	18 0 " 20 0	..	8 0 " 12 0	..
1840	15 0 " 0 0	..	7 0 " 0 0	..
1841	15 0 " 16 9	..	6 0 " 7 5	..
1842	12 6 " 14 0	..	not quoted.	..
1843	9 0 " 11 6	..	5 0 to 6 0	..
1844	15 0 " 18 0	..	not quoted.	..
1845	14 6 " 17 6	..	7 6 to 8 6	..
1846	12 0 " 14 6	..	8 0 " 8 6	..
1847	12 6 " 14 0	..	not quoted.	..
1848	9 6 " 11 0	..	4 9 to 0 0	..
1849	12 0 " 16 6	..	6 0 " 6 3	..
1850	15 0 " 17 6	..	8 0 " 8 6	..
1851	12 0 " 16 0	..	8 0 " 9 3	..
1852	13 0 " 15 0	..	8 0 " 9 0	..
1853	19 0 " 22 0	..	11 0 " 12 6	..
1854	12 0 " 15 0	..	7 6 " 8 6	..
1855	14 6 " 19 0	..	8 6 " 9 0	..
1856	19 0 " 21 6	..	11 0 " 0 0	..
1857	19 0 " 24 0	..	13 0 " 14 3	..
1858	15 0 " 17 0	..	8 9 " 10 0	..
1859	18 6 " 24 0	..	10 9 " 11 6	..
1860	22 0 " 32 0	37 0 to 38 0	10 0 " 11 3	..
1861	19 6 " 27 0	from 30s. upwards.	not quoted.	..
1862	18 6 " 26 0	30 0 to 37 0	11 6 to 16 0	..
1863	25 6 " 31 0	38 0 " 42 0	15 3 " 17 6	..
1864	31 0 " 39 0	47 0 " 54 0	17 6 " 20 0	..
1865	23 0 " 30 0	44 0 " 45 0	15 0 " 17 0	..
1866	24 0 " 30 6	30 0 " 38 0	14 0 " 16 0	..
1867	16 0 " 21 6	not quoted.	not quoted.	..
1868	19 0 " 26 0	28 0 to 32 0	8 6 to 9 0	..
1869	18 0 " 26 6	not quoted.	8 6 " 10 0	..
1870	15 0 " 23 6	25 0 to 26 0	9 6 " 0 0	..
1871	20 0 " 26 6	30 0 " 34 6	12 0 " 15 0	..
1872	26 0 " 37 6	40 0 " 48 0	18 0 " 21 0	..
1873	17 0 " 18 0	34 0 " 40 0	9 0 " 12 0	..
1874	18 6 " 26 6	30 0 " 34 0	9 6 " 13 0	..
1875	25 0 " 32 0	34 6 " 36 0	12 6 " 16 0	..
1876	20 0 " 24 0	30 0 " 34 6	9 6 " 12 0	..
1877	20 9 " 26 0	28 0 " 30 0	10 0 " 12 0	..
1878	18 9 " 25 0	27 0 " 32 0	8 6 " 11 6	..
1879	15 0 " 17 0	prices very low.	7 0 " 0 0	..
1880	20 0 " 24 0	30 0 to 32 0	10 6 " 11 6	14 0 to 15 0
1881	17 0 " 21 0	27 0 " 30 0	5 0 " 9 6	12 0 " 13 0
1882	14 0 " 18 0	27 6 " 28 0	7 6 " 9 0	13 0 " 14 0
1883	13 0 " 18 0	26 0 " 28 0	6 6 " 8 6	11 6 " 12 6
1884	13 0 " 18 0	26 0 " 28 0	6 6 " 8 6	11 6 " 12 6
1885	12 0 " 17 0	22 6 " 26 0	6 0 " 8 0	11 6 " 12 0
1886	13 0 " 18 0	23 0 " 27 6	6 6 " 8 6	11 6 " 12 0
1887	14 0 " 22 0	23 0 " 28 0	7 0 " 9 0	11 6 " 13 0
1888	13 0 " 20 0	23 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1889	13 0 " 18 0	24 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1890	13 0 " 18 0	24 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1891	12 6 " 18 0	22 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1892	12 0 " 18 0	20 0 " 28 0	7 0 " 8 6	10 6 " 12 0
1893	12 0 " 17 0	20 0 " 27 0	7 0 " 8 0	10 0 " 12 0

CHEMICAL DEPARTMENT.

PUMPHERSTON EXPERIMENTAL STATION.

THE SPECIFIC EFFECT OF VARIOUS MANURES UPON THE COMPOSITION OF MEADOW-GRASS CUT ANNUALLY.—*Final Report.*

By Dr A. P. Aitken, Chemist to the Society.

This experiment, which has been going on for six years, may now be considered as ended; and we are now in a position to learn the lessons it was intended to teach. The grass was sown out with barley in 1887. No manure was applied that year, and a crop of turnips had been grown and removed the year before without any manure being given. The object of that treatment was to discover what amount of residual fertility was still in the plots that had in former years been very variously manured. The first crop of grass was cut in 1888, and made into silage. In 1889 manuring of the same kind as had been practised in former years was resumed over one-third of each plot, while one-third was permitted to remain unmanured. There was thus the opportunity of seeing side by side two distinct inquiries—viz., first, the manner in which former manurings affected the fertility of the soil, or the rate of their exhaustion; and, second, the manner in which these manures when applied yearly affected the character of the grass.

The results of the first inquiry formed the subject of last year's report, and the results of the second inquiry form the subject of this report.

The very interesting and instructive experiments at Rothamsted to test the effects of the application of large quantities of different manures when put year after year on old meadow-grass, and of which a short account was given in the 'Transactions,' vol. xii. pp. 238-258 (1880), have shown that the mere persistent application of manures gradually alters the character of the grass in certain definite directions, and that the changes become accentuated as time goes on. It seemed to the

Chemical Committee that a useful modification of the Rothamsted experiments might be tried at Pumpherston under somewhat reversed conditions—viz., to grow young grass on land that had been manured in a definite manner during two rotations, and note whether the effects described by Lawes and Gilbert at Rothamsted took place from the first, and also how rapidly the character of young grass was altered by the persistent application of moderate quantities of different kinds of manures. It seemed that thereby some useful information would be got concerning the treatment of land that was being put down to grass, and the further treatment of the young grass itself.

The grass mixture sown in 1887 was just such a one as experience had shown to be useful in Mid-Lothian, and consisted, as is shown in Table I., of 35 per cent strong permanent

TABLE I.—GRASSES SOWN ON PUMPHERSTON STATION, 1887.

		Germination.	Quantity per acre.	No. of seeds per lb.	No. of germinating seeds per lb.	No. of germinating seeds per acre.	Percentage of seeds in the mixture.	
		p.c.	lb.				per cent.	
Meadow fescue .	*Festuca pratensis*	95	4	270,000	256,500	1,026,000	4.0	
Tall fescue . . .	" *elatior* .	85	3	264,000	224,400	673,200	2.6	13
Hard fescue . . .	" *duriuscula*	90	1½	628,000	565,200	847,800	3.2	
Sheep's fescue . .	" *ovina* . .	90	1½	628,000	565,200	847,800	3.2	
Rough-stalked meadow-grass	*Poa trivialis* . .	80	1½	2,581,000	2,065,600	3,098,400	12.0	
Smooth-stalked meadow-grass	" *pratensis* . .	70	1½	2,398,000	1,678,600	2,517,900	9.7	28
Wood meadow-grass	" *nemoralis* .	70	1	2,325,000	1,627,500	1,627,500	6.3	
Cocksfoot	*Dactylis glomerata*	95	6	494,000	469,300	2,815,800	11.0	
Timothy (catstail) .	*Phleum pratense* .	95	3	1,198,000	1,138,100	3,414,300	13.0	
Foxtail	*Alopecurus pratensis*	80	4	592,000	473,600	1,894,400	7.3	35
Dogstail	*Cynosurus cristatus*	80	1	842,000	673,600	673,600	2.6	
Pyrennial ryegrass.	*Lolium perenne* .	90	6	255,000	229,500	1,377,000	5.3	
Red clover . . .	*Trifolium pratense*	95	2	254,000	241,300	482,600	1.8	
Cow-grass	" "	95	3	236,000	224,200	672,600	2.5	19
Alsike	" *hybridum*	95	2	687,000	652,650	1,305,300	5.1	
White clover . . .	" *repens* .	95	4	653,000	620,350	2,481,400	9.6	

grasses, 28 per cent meadow-grasses, 13 per cent fescues, 5 per cent perennial ryegrass, and 19 per cent clovers. These percentages represent the numbers of germinating seeds. The first seeds to germinate and occupy the ground were the clovers and ryegrass, of which the great mass of the first year's crop consisted. During the second year these rapidly disappeared

and gave place to the more slowly maturing permanent grasses. The rapid change which occurred in the character of the herbage has formed the subject of an annual report in which full details are given of the history of the different plots and the different species of grass. Altogether apart from the manuring, or apart even from the character of the soil, a sweeping transition in the character of the grasses is inevitable from the nature of the plants sown. Those which are annuals will disappear after one year; the biennials will disappear after the second year, leaving the more permanent plants to compete with each other or co-operate with each other, as the case may be.

The extraordinary change on the herbage, due to the nature of the plants themselves, is seen in Table II., showing the alteration in the general character of the grasses during six years. In this table no notice is taken of white clover, which constitutes only about 1 per cent of the herbage, and of mown weeds, which constitute only one-tenth per cent. The numbers refer only to the grasses proper.

The greatest change that occurred is not shown in the table—viz., the almost entire disappearance of red clover after the first year.

TABLE II.—Alteration of Meadow-grass in Six Years.

	1888.	1889.	1890.	1891.	1892.	1893.
Ryegrass	89	44	15	5.2	3.2	2.7
Cocksfoot	...	12	25	47.6	43.9	48.1
Timothy	5	12	7	5.3	5.4	6.9
Dogstail	0.5	17	36	24.0	30.8	21
Foxtail	...	0.2	...	0.3	0.8	1.2
Meadow-grasses (poas)	3	7.5	2.5	1.1	4.7	1.4
Fescues	0.3	2.5	3	4.5	1.8	12.0
Yorkshire fog	2.2	4.8	11.5	12.0	9.4	6.7
	100.0	100.0	100.0	100.0	100.0	100.0

The first crop in 1888 consisted of 50 per cent ryegrass, 40 per cent clovers, 5 per cent permanent or natural grasses, as they are called, and 5 per cent mowable weeds. During the second year a few plants of red clover still lingered in some of the plots, and there would be from 2 to 3 per cent of alsike. Thereafter there was practically nothing to be seen of red clover nor of alsike, but white clover began to make itself apparent as a lowly plant, and now, after six years, it is spreading on many of the plots, but is so small as to escape the reaper, so that in the hay there is only about 1 per cent of it.

Leaving the clovers out of account altogether, it is seen that perennial ryegrass, which during the first year was almost the sole grass in the hay, was for the most part, if not entirely, an annual.

It is impossible to say how much of the ryegrass of later years was grown from the seed sown in 1887, and how much of it was the product of new seeds fallen from the ripe grass in the process of hay-making. There are still a few representatives of the species in the grass holding out tenaciously, and probably these may be a residuum of a permanent variety of ryegrass, but it is quite evident that the great mass of the ryegrass sown had no claim to be called perennial. Cocksfoot and dogstail have gradually come to be the leading grasses, fluctuating somewhat in their predominance according to the season.

In 1890 it seemed as if dogstail was going to crush out the cocksfoot, but that was a cold sunless summer. In 1891 there was drought as well as cold, and cocksfoot made a fresh advance. In 1892 there was another very cold summer, and dogstail advanced while cocksfoot retreated; but in 1893 there was a severe drought and a warm summer, during which cocksfoot regained its lost ground and dogstail received a severe check. The deep roots of the cocksfoot enabled it to compete successfully with dogstail during seasons of drought; but it would seem that dogstail endures cold well, and is less dependent on sunshine than cocksfoot.

In a series of experiments to investigate the rooting power of the more common grasses described elsewhere,[1] I found that not only did the roots of cocksfoot penetrate more deeply than those of dogstail, but of the whole mass of root matter, 24 per cent of the cocksfoot roots were lying on the lower two-thirds of their depth—that is to say, in the deeper layers of the soil—while only 18 per cent of the dogstail roots were in the deeper layers. The roots of the dogstail were therefore more superficial and more subject to injury from drought. The great drought of 1893 told very severely on that class of grasses whose roots are in the main superficial, hence the meadow-grass and Yorkshire fog suffered much, but the taller fescues throve very well. In the investigation referred to, I found that 40 per cent of the mass of the roots of the tall and common fescues are situated in the lower two-thirds of their length—that is to say, in the deeper layers of the soil,—on that account we see from Table II. that in 1893 the fescues have made an extraordinary advance. The rough meadow-grass, on the other hand, puts only 10 per cent of its roots into the deeper layers of the soil, and thus it is peculiarly subject to injury from drought, and thrives best on wet land and during wet seasons.

[1] Journal of the Botanical Society of Edinburgh, December 1891.

Considerations such as these show that the data contained in Table II. must not be read too absolutely. They are, of course, much affected by soil, but we see also that they are considerably affected by season.

As in former years, I have made a botanical separation of the grasses composing the hay secured in 1893, and the results are contained in Tables VI.-IX. (pp. 402-409). The manures applied to the various plots are shown in Table V. (p. 401). They are the same as in former years, and are founded upon the basis of 36 lb. per acre of phosphoric acid, potash, and nitrogen respectively, whatever the form of the manure applied.

In the first place, we may notice the results of the cropping during the last five years, both on the manured and unmanured sections. These are seen in Tables III. and IV. (pp. 399, 400). I have not included the first year's crop, as it consisted largely of clover, and, moreover, it was not made into hay.

It will at once be noticed, on comparing these two tables, that the total amount of hay removed from the manured section is not much more than half as much again as that got off the unmanured section. The explanation of that is to be found in the unfortunate cycle of seasons we have just passed through. The year 1889 was a fairly good hay year in the West Lothian district, but 1890 was a cold sunless summer, and 1891 and 1892 will long be remembered as the worst hay seasons in the district for a generation. The summer of 1893, propitious in almost every other respect, was too dry in May and June to produce a good hay crop, and was especially unfavourable to the action of top-dressings. Another circumstance affecting the comparison was the top-dressing of nitrate of soda put on all the unmanured section in 1891. That unduly raised the amount of crop on the otherwise unmanured section. If we limit our comparison to the last two years, 1892 and 1893, we see that the quantity of hay produced by the manured plots was just about double that grown on the others, and we may safely trust to the general teachings these two sections afford.

Plots 5 and 6 were very severely cut up in the winter of 1891 by carts carrying dung to a further field, and the crop of hay in 1892 was so considerably diminished thereby that it was resolved to plough them up. It was noticed, however, that the severe usage was affecting the kind as well as the quantity of the grass, and the plots were allowed to lie in grass another year. The result has been that these two plots, which had hitherto been backward, started afresh and made more progress than any other part of the field. The only explanation of that remarkable circumstance that occurs to me is that the manures—viz., bone-meal and dissolved bones—that have been lying dormant on the surface of the grass for years have

now been in a sense ploughed into the land and brought for the first time in contact with the roots of the grass. This accident has taught a valuable lesson—viz., that where grass is top-dressed with anything but perfectly soluble manures it is advantageous to bring them under the surface by some mechanical process, such as rolling with a heavy Cambridge roller or similar implement that will not only press but cut the sod; and that harrowing, succeeded by rolling or heavy treading with fat stock, or some such mechanical treatment which will cause the manure to sink into the grass, is necessary to make the top-dressing exert its most beneficial effect.

The want of some treatment of that kind has caused plot 7, that had its phosphate supplied in the insoluble form of fine bone-meal, to be almost no better than plot 11, which got no phosphate at all. As regards the other phosphates, the most soluble one—viz., superphosphate—has done best last summer, though during the five years the plot manured with Thomas-slag is somewhat in advance of it. Slag is itself a manure not very difficult of solution in the soil, but it may owe its superiority partly to the small amount of caustic lime it contains.

As with the phosphates so with the nitrogenous manures: during the drought of last summer they were effective as manures precisely in accordance with their relative solubility — viz., nitrate of soda, sulphate of ammonia, dried blood, and horn-dust —and that also is the order in which they rank in the total produce of the five years. In the case of the two last named some mechanical process would be expedient to drive them into the soil, just as in the case of bone-meal. There seems to be no difference in the long-run between sulphate and muriate of potash. As to the guanos, they are somewhat fluctuating in their results, but upon the whole there is little difference between Peruvian and Ichaboe. Fish-guano lags behind a little, just as bone-meal and horn-dust do, and would doubtless be all the better of being more intimately incorporated with the soil. As regards the two kinds of superphosphate, the more soluble one has some advantage over the other, as might be expected.

There are six plots incompletely manured, which are very interesting. Some people used to laugh at them as being ridiculous oddities, but now that the experiment is over they are seen to be the most valuable plots on the whole station—viz., plots 11 and 12, 17 and 18, 21 and 22.

Their results will be better seen if tabulated. When completely manured with the three ingredients — viz., nitrogen, potash, and phosphoric acid, as in plots 8 and 10 — the hay produced in five years amounted to 200 cwt. The incompletely manured plots produced the following:—

Plot.		Total yield. Cwts.
12.	Superphosphate alone	73½
18.	Nitrate of soda alone	139
22.	Potash manure alone	90
11.	No phosphate	170
17.	No nitrogen	116
21.	No potash	155½

It is quite evident from these results that the ingredient in a manure that is most necessary for grass is nitrogen. After that comes potash, and lastly phosphates.

Accustomed as we are to apply most of the manure of the rotation to the turnip crop—and as former experiments have abundantly shown the chief ingredient for that crop is phosphates—it is evident that a turnip manure, or the residue left by its use, consisting mostly of phosphates, is not a suitable manure for grass. My experience leads me to believe that much of the bad grass that prevails nowadays is due to the lop-sided way of manuring with almost nothing but phosphates. The grass is not so poor where the phosphate brought on to the farm is bone-meal, for bones contain a certain proportion of nitrogen.

We have seen that bone-meal, applied as a top-dressing, is an exceedingly poor manure, for want, as I have reason to believe, of its being able to get within range of the roots of the grass. That disqualification does not apply to bone material that has been applied to the turnip crop and ploughed in and incorporated with the soil. Bone-meal as a preparation for grass is a much better manure than mere phosphates on account of the nitrogen it contains; but still it is a deficient preparatory manure for grass, seeing that it contains no potash, for next to nitrogen grasses must have potash. Farmyard manure contains a large amount of both nitrogen and potash, and when applied to the turnip-break the residue left a year after becomes available for the sown-out seeds, but it is only a residue. The richness of grass to which farmyard manure has been applied as a top-dressing attests the need of grass for nitrogen and potash, and so do the excellent results obtained by feeding stock on grass with highly nitrogenous concentrated fodders.

Plot 18 shows that a fair crop of grass can be grown for a year or two by the application of a nitrogenous manure alone, especially during seasons of drought; but if this experiment had been continued another year, and a wet season had occurred, it would have been seen that plot 18 had gone down in its fertility far below the other plots of the section, such as plot 13. As it is, the continuous application of nitrate, without any phosphatic or potassic manures, has reduced the fertility of plot 18 by one-third.

It will be shown further on that the kind of grasses grown on these incompletely manured plots differs as widely as the quantity, and that more especially the effect of potash manures is to increase the quantity of clover. Recent researches have shown that clover under certain conditions has the power of supplying itself with nitrogen from the air, and of enriching the soil in that ingredient. It is probably this extraordinary power possessed by clover and other leguminous plants that gives to potash its great value as a constituent in a grass manure. Our experiments have shown the paramount importance of nitrogen as a constituent of a grass manure; but whether that nitrogen is more usefully and economically applied as a nitrogenous manure, or by encouraging the growth of clover and so gathering into the soil nitrogenous matter derived from the nitrogen of the air, is a question at present under investigation. Ardent advocates of the system of catching nitrogen from the air go so far as to say that grass should never have nitrogenous manures applied to it at all, and that the application of such a manure as nitrate of soda is not only an extravagance, but that it is injurious even to grass that is otherwise well manured. What is required, they say, is to bring about the condition of soil favourable to the growth of clover, and with plenty of clover there should be no need of any nitrogenous manures. Now, one of the essentials for the growth of clover and other leguminous plants is a plentiful supply of potash. There are other conditions necessary, some of which are not properly understood, but from a manurial point of view potash is the main essential.

The soil of Pumpherston is not rich in potash, but there are some plots which have received a superabundance of that manure, and certainly the clover on these plots is much more plentiful than on the others, and, moreover, on some plots which have been denied potash there is an entire absence of clover. Nevertheless, even on plot 17, which has had potash and superphosphate applied to it, and no nitrogen for a great many years, and on which the clover is growing more luxuriantly than on any other plot on the station, there is not a heavy crop of grass. It is one of the poorest plots on the station, and this shows clearly that though it is quite proved that clover can get nitrogen from the air, and that thereby the soil may be enriched with nitrogen, the process is a very slow one; and the small crop of grass produced shows that the amount of nitrogen fixed by the clover and imparted to the soil falls far short of the quantity required to promote a good growth of grass even after the turf has lain for six years. It may be that other characteristics of the soil are wanting, some other conditions favourable to the growth of the minute organisms whose presence and stimulus cause the

leguminous plants to absorb nitrogen from the air more rapidly. Whatever it be, it is certain that an application of 1 cwt. of nitrate of soda along with the potash and superphosphate applied to plot 17, would have nearly doubled the crop of hay on that plot during these six years.

We now come to the second part of the investigation—viz., What are the specific effects of different manures in promoting or retarding the growth of certain species of grass or other herbage?

A very careful botanical separation was annually made of samples of grass gathered from each plot at the time of cutting. Three or four persons went over each plot and gathered what he regarded as a representative bundle of his section, which would be about the fortieth of an acre. These bundles were laid out in layers on the top of each other, and mixed as evenly as possible. Thereafter a two-pronged instrument or fork was struck into the united layers at three places, and all that was enclosed within the prongs was taken apart, and the three samples thus taken were very carefully layered out and mixed together in the laboratory, one-half being taken for separation and the other half reserved as a duplicate. As the whole value of the experiment depended on the accuracy of the sample finally used, the greatest care was exercised to have that sample as just a representative of the total crop on each plot as possible. Absolutely accurate samples were of course unattainable, but double samplings of the same plot showed me that samples taken in the way described were fairly trustworthy.

During the first three years the rapid transition caused the crop of each year to be quite unlike its predecessor, and it was evident that any effects produced by the manures applied were a mere trifle compared with those due to the nature of seeds sown, and also to the general character of the soil. It was not until the fourth season that the crop could be said to have settled down into a somewhat permanent condition; and on comparing the botanical composition of the fourth, fifth, and sixth crops, it is seen that they are not very different. For the purpose of obtaining a fairly accurate view of the grasses on the station, we may therefore group together the results of the last three years and strike the average. That has been done on Table IX. (p. 408); and we may, in the first place; draw general conclusions from it, in so far as that can be done with safety, and thereafter we may notice how much one year differs from another in the nature of the grass produced, according as the season is more or less favourable to its growth.

On Table IX. are given the percentage by weight which each species of grass attained on each of the plots, and we may conveniently study them in the order in which they are given,

noting which of the three manurial constituents—phosphoric acid, potash, and nitrogen—are chiefly required for their growth.

Common Ryegrass.—The average amount of this grass on the plots fully manured was a little over 3 per cent, while on the imperfectly manured plots it averaged about 5 per cent during the last three years. It might seem from this that ryegrass was a hardy grass capable of growing under circumstances of poverty better than most grasses. That may be so, for it is a strong deep-rooting grass, and it may have been able to tap the soils of the poorest plots at a lower level than the other species. But there is another circumstance that has contributed to this result —viz., the fact that on the deficiently manured plots the grass ripened sooner—and as the ryegrass is prone to shed its seed on ripening, the increased proportion of ryegrass on these plots was probably due to resowing of the seed during hay-making. The total quantity is small, and it does not seem that any of the manures employed had any marked effect in encouraging the growth of ryegrass or causing it to assume the perennial habit that its name indicates. It rapidly died out despite the liberal application of all the three manurial constituents.

Cocksfoot.—This grass presents a striking contrast to ryegrass in nearly every particular. It requires for its vigorous growth a liberal supply of each of the three constituents. If any one is deficient, its vigour is impaired; but the one which is most urgently required by it is phosphoric acid, and it flourishes best on those plots where soluble phosphate is supplied, and it seems as if sulphuric acid in some form of combination were favourable to its growth.

Timothy.—The manurial constituent required most by this grass is nitrogen, and in the next place potash; but the want of phosphoric acid is not so much felt by it. This explains why it is that farmyard manure, which is especially rich in nitrogen and potash, is so appropriate a manure for timothy meadows.

Dogstail.—As before remarked, the main phenomenon presented by the grasses on the station during the last three years was the contest between cocksfoot and dogstail for possession of the ground, and while the issue has been determined a good deal by the character of the season, it is evident that the manuring also plays a very important part. It will be seen from an examination of the table that dogstail has the upper hand of cocksfoot in those plots that are poorest in the elements of fertility. On the incompletely manured plots it is taking the strongest hold of the ground, and on plot 12, which has been manured with phosphates alone for many years, it is not only the dominant grass, but constitutes nearly one-half of the total herbage. It would seem, therefore, that it grows better than most other grasses on poor land which is relatively well supplied

with phosphates. It is the flower-stalks of this grass that give the white parched appearance to so many meadows in autumn; and while it is undoubted that the predominance of that grass on many lands is favoured by the fact that its rough seed-stalks are refused by stock and permitted to ripen and sow their seed year after year, it is also seen that it flourishes better than other grasses on thinnish land, or on land in poorish condition, and to which excess of phosphatic manures has been applied. This is characteristic of very large tracts of arable land in this country, where the phosphatic manures applied to the turnip-break form the only substantial addition to the fertility of the farm that is brought in from without; and if we may trust the indications given by this experiment, it is on such land that crested dogstail is likely to become the dominant grass.

The roots of this grass, though of a strong habit and very plentiful, do not penetrate far. Four-fifths of their total weight are found matted together in the upper third of their length, and they are therefore comparatively independent of subsoil nourishment. This grass will naturally become a dominant grass on a soil with a stiff tilly subsoil, such as is found at Pumpherston. Owing to its comparatively shallow rooting power, it will not be able to withstand frost or drought so well as cocksfoot, and we find that the cold winter and hot dry summer of last year have checked it pretty severely; but it only wants a succession of dull moist seasons to assert its superiority over the deeper grasses. It is a very hardy grass, and is less dependent on sunshine than the larger-seeded grasses. Owing to its superficial habit and abundant store of roots, it is the first to seize upon any nourishment supplied as top-dressings; and if these are in the form of insoluble phosphates, the roots of the crested dogstail will be more able to make use of them than cocksfoot or any of the deeper-rooting grasses.

Foxtail.—This is the shyest grass on the station. It has only very slowly begun to creep into the meadow, and while it is increasing in quantity year by year, the quantity is so small and the growth so sporadic that no definite conclusions can be drawn from the results of these experiments.

Meadow-grasses.—Both the rough-stalked and the smooth-stalked varieties were sown in the original mixture, $1\frac{1}{2}$ lb. per acre of each; but it was the rough-stalked species (*Poa trivialis*) that first took up a position in the meadow and promised at one time to be an important constituent. After the second year it dwindled away, and the smooth-stalked species (*Poa pratensis*) became more common; but it too has gradually become scarce. They do not seem to feel the want of nitrogen so much as most grasses, but it is their habit of rooting that has chiefly determined their position. *Poa trivialis*, though strong in flower, is

a small-leaved and rather shallow-rooting grass. It lives almost wholly in the upper soil, and is therefore easily injured by frost and drought. The smooth-stalked meadow-grass, on the other hand, sends a considerable proportion of its roots down into the subsoil, is much more leafy, and is able to grow and abide in the field when the other has succumbed.

Fescues.—There were four species of fescue sown, but it is only the two taller ones, *F. elatior* and *F. pratensis*, that are of any importance in a meadow. The hard fescue and sheep's fescue may have a good purpose to serve on a hill pasture, but it is only the two former that contribute materially to the bulk of the hay crop. They are both deep-rooting grasses, having an unusually large proportion of their roots in the deeper layer of the soil and subsoil. They are therefore able to endure drought better than any other grass. Indeed the manner in which these two fescues endured the long-continued drought of 1893 was the most noteworthy thing on the station last year. During the cold dull summer of the previous year they were very backward, and it was evident that the want of light and warmth was very unfavourable to their growth; but during the bright warm summer of 1893 they not only did not suffer, as all the other species did, but they produced more than double the weight of hay they had ever done before. This superiority they owed to the twofold advantage of having their roots down deep enough to secure moisture, and of having strong sunshine to grow and mature their heavy seeds. As regards their manurial requirements, they seem to have no special need of one constituent more than another; and the fact that they find much of their nourishment in the deeper layers of the soil, makes them less dependent on top-dressings than most grasses.

Yorkshire Fog.—In striking contrast to cocksfoot and the taller fescues, this grass lives in the upper layer of the soil, and finds means of subsistence in circumstances where the deeper-rooting grasses would starve. When growing on good soil it assumes a tufty habit of growth, but on poor soils where it ripens early and seeds freely it spreads itself over the meadow abundantly and has a sparse habit. Owing to its shallow roots it is peculiarly liable to be injured by drought, and hence in the summer of 1893 it received a very severe check. There was a considerable increase in the number of flowering stalks, but they were of a light, poor, attenuated kind, with very few leaves, and contributed little to the weight of the hay. As might be expected from its shallow habit, it succeeds best on soils that are top-dressed with insoluble manures which cannot penetrate far enough to afford nourishment to the deeper-rooting grasses. Hence bone-meal, horn-dust, dried blood, and guanos are manures which favour its growth, whilst superphosphates,

nitrate of soda, and potash manures, which reach the deeper layers, favour the deeper-rooting grasses, and succeed in ousting the Yorkshire fog from the meadow. The abundant and wide-spread growth of this grass is a sign of a thin soil, or one with a poor subsoil, or a soil deficient in nitrogen, and containing the most of its nourishment on the surface.

Clovers.—The only clover now growing on the station is white clover. A head of red clover is apparent here and there, but it is the white clover, and mainly the flowers of it, which go to make up the percentages contained in the second last column of the table. The leaves of the plant are for the most part found creeping close to the sod, and the great majority of them escape the reaper, and are lost to the hay. Owing to this circumstance, the percentages of clover found in the hay convey a very inadequate idea of the prevalence of the white clover on the different plots. On walking over the station, however, one is struck with the great differences between the plots as regards this constituent. It may be said, in a word, that where potash manures have been applied in greatest proportion there the clover is at its best, wherever potash fails clover fails, and on plots where no potash has been applied there is almost no clover. Wherever soluble nitrogenous manures have been applied the plots are deficient in clover. On the other hand, where insoluble nitrogenous manures—such as bone-meal, horn-dust, dried blood, fish-guano, and the like—have been applied the clover thrives well. As regards phosphatic manures, it does not seem to show any preference for one kind over another except Thomas-slag, which seems to suit it remarkably well; but it is probable that that is due more to the excess of lime contained in that phosphate than to the phosphoric acid itself.

Weeds.—This is another constituent of the hay that is apt to create an erroneous impression. Before weeds can form part of the hay, they must have attained some size and be of an erect habit of growth. It is these only that are noted in the last column of the table; but it is not the taller weeds that are the most pernicious, it is the lowly weeds that creep over the surface of the soil and choke it up, interfering with its ventilation and smothering out the grasses proper. There was no moss nor fog in the hay samples, even from the poorest plots, but on the plots themselves there was plenty to be seen. The deficiently manured plots and the unmanured section were distinguished by the sparseness of the grasses and the presence of numerous patches of unoccupied soil, which were the home and feeding-ground of mosses and other lowly weeds. Even on some of the best plots mosses were not wanting, and I am not at all certain that their presence is a thing to be

regretted. Where bare spots occur in a field a covering of mosses is better than nothing at all. They are accumulating organic matter in their humble way, and that is of some service on thin land. They vary very widely in character. There are species of moss which have no great body, but which cover the ground closely with a thin adherent film, and which thereby interfere with the ventilation of the soil. It is probable that these do more harm than good. On the other hand, there are many species with a branching roving habit that thread their way among the grasses, and it may be, and indeed it seems probable, that such mosses have a useful function to perform in a meadow or pasture. They are at their best, and cover the ground in the winter and early spring, when the grasses are at their worst; but as soon as the grasses feel the touch of spring they shrink and shrivel, and by their decay they may be of some service to the more stately occupants of the turf. They deserve to be studied in connection with the growth of grass, when it will probably be found that their entire extirpation is by no means desirable.

[TABLES

TABLE III.—HAY CROP, 1889 TO 1893.—*Unmanured Section B.*

No. of Plot.	Manures applied in 1878, 1879, 1881, 1882, 1883, 1884, and 1885. No manures applied in 1886, 1887, 1888, 1889, 1890, 1892, and 1893. (Nitrate of soda, 1 cwt. per acre applied in 1891).	Cwt. per acre.					Total.
		1889.	1890.	1891.*	1892.	1893.	
	Phosphatic Manures.						
	With nitrate of soda and potash salts—						
5	Bone-meal	24	24	18	...	...	...
6	Do. dissolved	27	27	24	...	...	...
7	Phosphatic guano	30	27	21	16	18	112
8	Do. do. dissolved . . .	30	24	24	20	12	110
9	Ground mineral phosphates . . .	27	27	27	13	10	104
10	Do. do. dissolved .	27	30	24	13½	16	110½
11	No phosphates	27	25	15	12	10	89
12	Bone-ash alone	21	12	24	16½	12	85½
	Nitrogenous Manures.						
	With superphosphate and potash salts—						
13	Nitrate of soda	27	29	24	18	25	123
14	Sulphate of ammonia	27	24	24	12	13	100
15	Horn-dust (shoddy 1878)	33	30	24	22½	25	134½
16	Dried blood	39	27	30	13½	10	119½
17	No nitrogen	30	26	24	18	12	110
18	Nitrate of soda alone	24	20	24	22	11	101
	Potassic Manures.						
	With superphosphate and nitrate of soda—						
19	Sulphate of potash	33	27	25½	19½	9	114
20	Muriate of potash	33	19	19½	15	10	96½
21	No potash	27	25	22½	23	13	110½
22	Potash salts alone	27	21	16½	12	13	89½
	Guanos.						
23	Peruvian	30	30	22½	18	23	123½
24	Fish	33	18	19½	10	7	87½
25	Ichaboe	24	25	19½	16½	15	95
27	Unmanured continuously	14	13	15	9	8½	59½
	Superphosphates.						
	With sulphate of ammonia and potash salts—						
28	10 per cent soluble phosphate	24	18	18	17½	11	88½
29	25 do. do.	21	15	19½	...	9	...
30	40 do. do.	30	24	15	10½	7	86½

* Nitrate of soda alone 1 cwt. per acre, 1891.

TABLE IV.—Hay Crop, 1889 to 1893.—*Manured Section.*

No. of Plot.	Manures applied.	Cwt. per acre.					Total.
		1889.	1890.	1891.	1892.	1893.	
	General character of season	warm dull	cold dull	cold dry	cold dull	hot dry	
	Phosphatic Manures.						
	With nitrate of soda and potash salts—						
5	Bone-meal	37	33	21	...	...	...
6	Do. dissolved	46½	39	25½	...	...	...
7	Phosphatic guano	49½	36	25½	31	27	169
8	Do. do. dissolved	54	40½	34½	40½	36	205½
9	Ground mineral phosphates	46½	42	24	29½	30	172
10	Do. do. dissolved	49½	40	33	37	37½	197
11	No phosphates	51	43½	24	26	26	170
12	Bone-ash alone	18	21	9	12	13½	73½
	Nitrogenous Manures.						
	With superphosphate and potash salts—						
13	Nitrate of soda	49½	38	28½	28	33	177
14	Sulphate of ammonia	37½	38	28½	31	29	164
15	Horn-dust (shoddy 1878)	36	31	25½	28½	25½	146½
16	Dried blood	36	39½	21	36½	26	159
17	No nitrogen	33	28	13½	22	19½	116
18	Nitrate of soda alone	42	33	22½	19	23	139
	Potassic Manures.						
	With superphosphate and nitrate of soda—						
19	Sulphate of potash	55	36	27	29	35	182
20	Muriate of potash	54	33	30	31½	32	180½
21	No potash	48	36	25½	22	24	155½
22	Potash salts alone	24	21	13½	15	16½	90
	Guanos.						
23	Peruvian	46½	27½	16	25½	34	149½
24	Fish	34½	29½	19	25	26	134
25	Ichaboe	43	40	19	23	31	156
	Superphosphates.						
	With sulphate of ammonia and potash salts—						
28	10 per cent soluble phosphate	42	33	24	24	28	151
30	40 do. do.	43½	36	27	26	28	100½
	Unmanured.						
27	Continuously	14	13	9	9	8½	53½
29	Since 1889	...	21	15	11	10½	...

TABLE V.—MANURES APPLIED IN APRIL 1893 (LB.), SECTION A.

No. of Plot.	Bone-meal.	Dissolved bones.	Steamed bone-flour.	Thomas-slag.	Mineral phosphate.	Superphosphate.	Nitrate of soda.	Sulphate of ammonia.	Horn-dust.	Meat-meal.	Castor-dust.	Peruvian guano.	Fish-guano.	Ichaboe guano.	Sulphate of potash.	Muriate of potash.
5	18	..	..	..	..	..	12	..	..	..	..	..	..	..	24	..
6	..	22	..	..	..	..	12	..	..	..	..	..	..	..	24	..
7	..	..	11	..	..	..	14	..	..	..	..	..	..	..	24	..
8	..	..	..	18	..	..	16	..	..	..	..	..	..	..	24	..
9	..	..	..	..	12	..	16	..	..	..	..	..	..	..	24	..
10	..	..	..	..	..	24	16	..	..	..	..	..	..	..	24	..
11	..	..	..	..	..	..	16	..	..	..	..	..	..	..	24	..
12	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	24	16	..	..	..	..	..	..	..	24	..
14	..	..	..	..	..	24	..	13	..	..	..	..	..	..	24	..
15	..	..	..	..	..	24	..	..	17	..	..	..	..	..	24	..
16	..	..	..	..	..	24	..	..	..	25	..	..	..	..	24	..
17	..	..	..	..	..	24	..	..	..	..	..	..	..	..	24	..
18	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	24	16	..	..	..	..	..	..	..	24	..
20	..	..	..	..	..	24	16	..	..	..	..	..	..	..	..	16
21	..	..	..	..	..	24	16	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..
23	..	..	..	..	..	..	..	..	..	..	..	30	..	..	18	..
24	..	..	..	..	..	..	..	..	..	..	..	..	30	..	24	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	24	24	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	24	..	13	..	..	..	..	..	..	24	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	18	..	13	..	..	..	..	..	..	24	..
31 & 32 *a*	..	..	..	..	..	24	12	..	..	..	..	..	..	..	24	..
31 & 32 *b*	..	..	..	..	..	24	24	..	..	..	..	..	..	..	24	..
31 & 32 *c*	..	..	..	..	..	24	36	..	..	..	..	..	..	..	24	..
33 & 34 *a*	..	..	..	..	..	24	..	10	..	..	..	..	..	..	24	..
33 & 34 *b*	..	..	..	..	..	24	..	20	..	..	..	..	..	..	24	..
33 & 34 *c*	..	..	..	..	..	24	..	30	..	..	..	..	..	..	24	..
35 *a*	..	..	..	..	..	36	24	..	..	..	..	..	..	..	36	..
35 *b*	..	..	..	..	..	36	..	..	..	..	90	..	..	..	36	..
36 *a*	..	..	..	..	..	36	..	20	..	..	..	..	..	..	36	..
36 *b*	..	..	..	..	..	36	..	20	..	..	..	..	..	..	36	..
37 *a*	..	..	..	..	..	36	..	20	..	..	..	..	..	..	36	..
37 *b*	..	..	..	..	..	36	..	20	..	..	..	..	..	..	36	..

TABLE VI.—HAY CROP, 1893. NUMBER OF GRASSES OF EACH SPECIES (PER CENT).

No. of Plot.	Manures applied.		Ryegrass.	Cocksfoot.	Timothy.	Dogstail.	Foxtail.	Meadow Grasses.	Tall and Meadow Fescues.	Hard and Sheep's Fescues.	Yorkshire Fog.	Clover.	Weeds.
	Phosphatic Manures.												
7	Steamed bone-flour	With nitrogen and potash.	10.0	26.5	4.4	27.2	.4	4.5	3.0	3.9	8.2	10.9	1.0
8	Thomas-slag	With nitrogen and potash.	4.5	28.0	2.0	30.3	1.3	2.0	3.1	6.6	11.6	9.6	1.0
9	Ground mineral phosphate	With nitrogen and potash.	4.7	38.8	4.4	28.8	...	5.0	.	5.0	10.2	2.5	...
10	Superphosphate	With nitrogen and potash.	4.4	44.8	1.2	16.7	.3	2.5	4.9	1.0	22.4	.7	1.1
11	No phosphate	With nitrogen and potash.	8.3	17.7	4.5	40.2	.5	1.1	2.3	12.8	10.6	2.0	...
12	Superphosphate alone		12.0	15.8	1.7	28.1	...	3.4	7.0	12.6	15.8	1.9	1.7
	Nitrogenous Manures.												
13	Nitrate of soda	With phosphate and potash.	6.0	30.6	1.6	27.0	.1	3.1	4.3	9.2	13.0	4.0	1.1
14	Sulphate of ammonia	With phosphate and potash.	5.6	27.8	1.1	16.5	1.7	1.5	3.7	3.0	31.7	3.7	2.0
15	Horn-dust	With phosphate and potash.	4.8	27.5	5.0	21.7	.1	7.2	3.9	4.0	16.0	8.8	1.0
16	Dried blood	With phosphate and potash.	9.4	28.7	3.1	13.2	1.2	6.4	6.4	1.9	18.0	6.6	...
17	No nitrogen	With phosphate and potash.	7.8	23.4	1.6	23.2	.2	4.7	1.6	3.6	7.7	26.2	...
18	Nitrate of soda alone		16.9	22.7	4.5	28.3	2.3	2.5	4.1	7.7	8.9	1.1	1.0

	Potassic Manures.											
19	Sulphate of potash } With nitrogen and phosphates.	4.3	47.7	2.2	23.7	2.1	5.9	2.8	2.5	6.8	.7	1.3
20	Muriate of potash } With nitrogen and phosphates.	7.9	21.3	7.3	23.8	2.7	5.5	4.1	7.3	15.9	3.2	1.0
21	No potash } With nitrogen and phosphates.	3.2	39.9	2.2	26.9	.1	1.8	2.9	5.1	17.9	...	...
22	Potash salts alone	2.0	17.4	9.1	30.2	.6	3.7	14.6	3.0	15.1	4.3	...
	Guanos.											
23	Peruvian (with ammonia)	5.9	17.7	3.0	29.4	1.3	6.4	4.0	4.4	20.9	5.3	2.7
24	Fish	5.5	18.7	9.7	19.0	.5	5.8	9.8	1.2	9.8	11.9	8.1
25	Ichaboe	4.1	20.1	4.7	30.7	.3	5.4	6.0	3.0	16.8	6.9	2.0
	Superphosphates.											
28	27 per cent superphosphates } With nitrogen and potash.	6.1	23.0	6.0	33.3	2.7	4.5	8.5	1.7	11.8	1.2	1.2
30	36 per cent do. } With nitrogen and potash.	3.3	26.2	6.0	27.0	1.4	3.3	6.7	6.8	18.6	.7	...
	Unmanured.											
27	Unmanured	10.5	22.8	3.3	15.1	...	2.1	6.1	22.2	15.4	2.5	...
29	Since 1889	2.0	17.3	3.5	41.4	.2	1.3	9.6	9.8	13.8	1.1	...
	Complementary Manures.											
11c	Phosphate alone	5.8	38.7	.7	23.9	.6	6.2	9.3	8.5	4.9	1.4	...
12c	Nitrogen and potash (no phosphate)	3.8	23.0	2.9	17.5	1.0	2.7	2.6	9.0	29.7	7.8	...
17c	Nitrogen alone	5.4	27.4	3.9	39.2	5.4	5.4	6.9	4.8	8.6	1.8	1.2
18c	Phosphate and potash (no nitrogen)	7.8	26.6	1.7	12.1	.3	2.6	4.8	10.3	25.4	6.5	1.9
21c	Potash alone	4.3	37.0	1.1	23.0	...	2.7	2.7	3.7	9.1	15.3	1.1
22c	Phosphate and nitrogen (no potash)	3.2	32.3	5.4	23.1	.9	.9	7.5	6.7	16.2	2.6	1.2

TABLE VII.—HAY CROP, 1893. BOTANICAL ANALYSIS. WEIGHT OF DIFFERENT SPECIES OF GRASSES (PER CENT).

No. of Plot	Manures applied.	Ryegrass.	Cocksfoot.	Timothy.	Dogstail.	Foxtail.	Meadow Grasses.	Tall and Meadow Fescues.	Hard and Sheep's Fescues.	Yorkshire Fog.	Clover.	Weeds.
	Phosphatic Manures.											
7	Steamed bone-flour — With nitrogen and potash.	4.0	51.2	8.1	22.3	.5	1.8	5.5	1.0	3.5	2.0	.1
8	Thomas-slag — With nitrogen and potash.	1.8	53.3	3.6	24.5	1.7	.8	5.7	1.7	4.9	1.7	.1
9	Ground mineral phosphate — With nitrogen and potash.	1.6	63.6	6.9	20.1	...	1.7	.9	1.1	3.7	.4	...
10	Superphosphate — With nitrogen and potash.	1.4	69.4	1.7	11.0	.3	.8	7.3	.2	7.7	.1	.1
11	No phosphate — With nitrogen and potash.	3.6	37.0	8.9	35.8	.7	.5	4.6	3.6	4.9	.4	...
12	Superphosphate alone	5.6	35.4	3.7	26.7	...	1.6	14.8	3.8	7.8	.4	.2
	Nitrogenous Manures.											
13	Nitrate of soda — With phosphate and potash.	2.3	56.4	2.7	21.2	.2	1.2	7.6	2.3	5.3	.7	.1
14	Sulphate of ammonia — With phosphate and potash.	2.3	52.2	2.0	13.9	2.3	.6	7.0	.8	13.9	.7	.2
15	Horn-dust — With phosphate and potash.	1.9	52.2	9.0	17.5	.1	2.8	7.1	1.0	6.7	1.6	.1
16	Dried blood — With phosphate and potash.	3.7	54.5	5.6	10.6	1.5	2.5	11.5	.5	8.0	1.2	.4
17	No nitrogen — With phosphate and potash.	3.7	53.5	3.5	22.5	.3	2.2	3.6	1.1	3.9	5.7	...
18	Nitrate of soda alone	6.8	44.0	8.2	23.3	3.0	1.0	7.6	2.0	3.8	.2	.1

	Potassic Manures.											
19	Sulphate of potash } With nitrogen and phosphate.	1.3	70.1	3.1	14.8	2.1	1.8	3.9	.5	2.2	.1	.1
20	Muriate of potash } With nitrogen and phosphate.	3.2	41.1	13.3	19.6	3.6	2.2	7.6	1.9	6.8	.6	.1
21	No potash } With nitrogen and phosphate.	1.1	64.4	3.3	18.5	.1	.6	4.5	1.1	6.4	...	...
22	Potash salts alone	.7	29.7	14.8	21.9	.7	1.3	23.8	.7	5.7	.7	...
	Guanos.											
23	Peruvian (with ammonia)	2.7	39.2	6.3	27.3	.5	2.9	8.3	1.3	10.1	1.1	.3
24	Fish	2.2	36.0	17.7	15.6	.7	2.3	18.0	.3	4.2	2.2	.8
25	Ichaboe	1.7	39.9	8.8	25.9	.4	2.2	11.4	.8	7.4	1.3	.2
	Superphosphates.											
28	27 per cent superphosphate } With nitrogen and potash.	2.2	39.6	9.8	24.4	3.2	1.6	14.0	.4	4.5	.2	.1
30	36 per cent do. . } With nitrogen and potash.	1.2	45.8	9.9	20.1	1.7	1.2	11.2	1.6	7.2	.1	...
	Unmanured.											
27	Continuously	4.6	48.1	6.6	13.5	...	.9	12.3	6.3	7.2	.5	...
29	Since 1889	.8	32.8	6.3	33.4	.3	.5	17.4	2.5	5.8	.2	...
	Complementary Manures.											
11*c*	Phosphate alone	1.9	60.7	1.1	16.0	.6	2.0	14.0	1.8	1.7	.2	...
12*c*	Nitrogen and potash (no phosphate)	1.7	49.7	6.0	16.1	1.5	1.2	5.4	2.6	14.2	1.6	...
17*c*	Nitrogen alone	1.9	46.6	6.3	21.1	6.3	1.9	11.2	1.1	3.2	.3	.1
18*c*	Phosphate and potash (no nitrogen)	3.4	54.4	3.3	10.7	.4	1.1	9.6	2.9	11.7	1.3	.2
21*c*	Potash alone	1.6	66.2	1.9	17.5	...	1.0	4.6	.9	3.6	2.6	.1
22*c*	Phosphate and nitrogen (no potash)	1.1	53.2	8.4	16.2	1.1	.3	11.8	1.5	5.9	.4	.1

TABLE VIII.—HAY CROP, 1893. WEIGHT OF EACH SPECIES (IN CWTS. PER ACRE).

No. of Plot.	MANURES APPLIED.	Ryegrass.	Cocksfoot.	Timothy.	Dogstail.	Foxtail.	Meadow Grasses.	Tall and Meadow Fescues.	Hard and Sheep's Fescues.	Yorkshire Fog.	Clover.	Weeds.
	Phosphatic Manures.											
7	Steamed bone-flour (With nitrogen and potash.)	1.1	13.8	2.2	6.0	.1	.5	1.5	.3	.9	.5	.1
8	Thomas-slag (With nitrogen and potash.)	.6	18.4	1.2	8.4	.6	.3	2.0	.6	1.7	.6	.1
9	Ground mineral phosphate (With nitrogen and potash.)	.4	16.2	.8	5.1	...	.4	.2	.3	.9	.1	...
10	Superphosphate (With nitrogen and potash.)	.5	26.0	.6	4.1	.1	.3	2.7	.1	2.9	.1	.1
11	No phosphate (With nitrogen and potash.)	.8	7.8	1.9	7.5	.1	.1	1.0	.8	1.0	.1	.1
12	Superphosphate alone	.8	4.8	.5	3.6	...	.2	2.0	.5	1.0	.1	.1
	Nitrogenous Manures.											
13	Nitrate of soda (With phosphate and potash.)	.6	14.4	.7	5.4	.1	.3	1.9	.6	1.3	.2	.1
14	Sulphate of ammonia (With phosphate and potash.)	.7	17.4	.6	4.4	.7	.2	2.2	.2	4.4	.2	.1
15	Horn-dust (With phosphate and potash.)	.5	12.9	2.2	4.3	.1	.7	1.8	.2	1.7	.4	.1
16	Dried blood (With phosphate and potash.)	1.2	18.0	1.8	3.5	.5	.8	3.9	.2	2.6	.4	.1
17	No nitrogen (With phosphate and potash.)	.7	10.4	.7	4.4	.1	.4	.7	.2	.8	1.1	...
18	Nitrate of soda alone	1.5	9.9	1.8	5.2	.7	.2	1.7	.4	.9	.1	.1

	Potassic Manures.											
19	Sulphate of potash } With nitrogen and phosphate.	.4	24.2	1.1	5.1	.7	.6	1.3	.2	.8	.1	.1
20	Muriate of potash } With nitrogen and phosphate.	1.1	14.8	4.8	7.1	1.3	.8	2.7	.7	2.4	.2	.1
21	No potash } With nitrogen and phosphate.	.3	15.5	.8	4.4	.1	.1	1.1	.3	1.5	...	...
22	Potash salts alone	.1	4.8	2.4	3.6	.1	.2	3.9	.1	.9	.1	...
	Guanos.											
23	Peruvian (with ammonia)	.8	12.0	1.9	8.4	.1	.9	2.5	.4	3.1	.3	.1
24	Fish	.7	11.3	5.6	4.9	.2	.7	5.7	.1	1.3	.7	.2
25	Ichaboe	.5	12.0	2.6	7.8	.1	.7	3.4	.2	2.2	.4	.1
	Superphosphates.											
28	27 per cent superphosphates } With nitrogen and potash.	.6	11.0	2.7	6.8	.9	.4	3.9	.1	1.2	.1	.1
30	36 per cent do. } With nitrogen and potash.	.3	13.0	2.8	5.7	.5	.3	3.2	.5	2.0	.1	...
	Unmanured.											
27	Continuously	.4	4.3	.6	1.2	...	.1	1.1	.6	.6	.1	...
29	Since 1889	.1	3.4	.7	3.5	.1	.1	1.8	.3	.6	.1	...
	Complementary Manures.											
11c	Phosphate alone	.3	10.9	.2	2.9	.1	.4	2.5	.3	.3	.1	...
12c	Nitrogen and potash (no phosphate)	.5	13.4	1.6	4.3	.4	.3	1.5	.7	3.8	.4	...
17c	Nitrogen alone	.7	16.1	2.2	7.3	2.2	.7	3.9	.4	1.1	.1	.1
18c	Phosphate and potash (no nitrogen)	.8	12.9	.8	2.5	.1	.3	2.2	.7	2.7	.3	.1
21c	Potash alone	.3	14.4	.4	3.8	...	.2	1.0	.2	.8	.6	.1
22c	Phosphate and nitrogen (no potash)	.2	8.8	1.4	2.7	.2	.1	1.9	.2	1.0	.1	.1

TABLE IX.—AVERAGE, 1891-92-93. WEIGHT OF DIFFERENT SPECIES OF GRASSES (PER CENT).

No. of Plot.	MANURES APPLIED.		Ryegrass.	Cocksfoot.	Timothy.	Dogstail.	Foxtail.	Meadow Grasses.	Fescues.		Yorkshire Fog.	Clover.	Weeds.
									Tall.	Short.			
	Phosphatic Manures.												
7	Steamed bone-flour	With nitrogen and potash.	3.6	46	5.0	22	...	1.2	3.7	1.4	13.5	2.8	.4
8	Thomas-slag		3.3	50	4.9	24	.7	.9	4.0	1.7	9.0	1.4	...
9	Ground mineral phosphate		2.6	57	4.4	23	.1	1.0	1.0	1.0	8.0	.8	...
10	Superphosphate		3.4	66	5.5	12	.1	.8	5.0	.9	6.5	1.0	.5
11	No phosphate		3.9	39	7.2	31	.5	.6	3.0	3.0	11.0	.7	.7
12	Superphosphate alone		5.8	23	3.4	44	...	1.1	7.0	2.0	11.0	.9	.6
	Nitrogenous Manures.												
13	Nitrate of soda	With phosphate and potash.	3.4	51	3.6	26	.4	.8	4.0	1.3	9.0	.7	.1
14	Sulphate of ammonia		3.0	51	3.3	21	2.0	.7	3.5	.7	12.5	.6	.4
15	Horn-dust		3.0	43	5·7	23	.2	2.7	4.0	.8	16.0	1.4	.2
16	Dried blood		5.1	55	4.4	17	.5	1.7	3.0	.4	12.0	3.1	...
17	No nitrogen		5.0	49	3.0	24	.7	1.4	4.0	.8	10.0	3.0	.5
18	Nitrate of soda alone		6.0	31	9.3	36	1.8	.6	7.0	1.4	6.0	.2	.2

	Potassic Manures.											
19	Sulphate of potash } With nitrogen and phosphate.	3.6	62	5.3	19	1.9	1.3	3.0	.2	5.0	.2	...
20	Muriate of potash } With nitrogen and phosphate.	4.5	44	4.7	20	2.0	2.0	6.0	1.0	7.5	.6	...
21	No potash } With nitrogen and phosphate.	4.6	48	5.8	29	...	.9	4.0	1.3	5.0	.2	.2
22	Potash salts alone	3.1	28	10.0	33	.2	1.4	13.0	1.0	6.5	2.5	...
	Guanos.											
23	Peruvian (with ammonia)	4.0	38	5.9	28	1.0	1.8	6.0	1.2	11.5	1.4	.7
24	Fish	2.3	34	11.5	15	.8	2.0	11.0	1.1	13.5	1.9	.3
25	Ichaboe	2.4	41	10.0	24	.2	1.6	7.0	.7	13.5	1.0	.4
	Superphosphates.											
28	27 per cent superphosphates } With nitrogen and potash.	2.5	43	10.0	25	2.0	1.4	8.0	.5	4.0	.3	...
30	36 per cent do. } With nitrogen and potash.	1.9	59	6.3	25	1.5	1.2	6.0	1.0	6.0	1.0	...
	Unmanured.											
27	Continuously	6.0	34	5.0	26	...	.7	11.0	4.0	8.5	.5	...
29	Since 1889	3.4	40	4.1	36	.1	1.0	8.0	1.2	4.0	1.0	...
	Complementary Manures.											
11c	Phosphate alone	2.5	46	2.7	28	...	1.6	8.0	1.2	7.0	.8	...
12c	Nitrogen and potash (no phosphate)	2.0	43	5.0	24	.6	.6	3.0	1.6	16.0	1.1	...
17c	Nitrogen alone	3.4	33	5.2	23	2.2	1.4	6.6	1.4	6.2	.2	...
18c	Phosphate and potash (no nitrogen)	4.2	53	6.0	17	.3	1.4	6.0	2.0	10.0	1.1	.1
21c	Potash alone	3.6	50	3.2	24	...	1.3	4 1	2.2	7.6	2.7	.1
22c	Phosphate and nitrogen (no potash)	1.9	53	6.0	24	1.1	.7	7.0	1.5	6.0	...	.1

DOES CHEMICAL ANALYSIS AFFORD A RELIABLE INDICATION OF THE FEEDING QUALITY OF A PASTURE?

It is commonly observed that some pastures which grow abundance of grass, and whose grass seems to be relished by cattle, do not fatten stock so well as other pastures where the grass is apparently no more plentiful. There is a difference in the feeding quality of the grass which cannot be detected by even the most practised eye, and therefore it seemed a subject worthy of investigation to see how far it is possible by our present methods of chemical analysis to determine the relative feeding value of the grass grown on pastures of different fattening capabilities. I communicated with some members of the Society and of agricultural associations who I thought might have such pastures, and owing to their kind co-operation I was provided with a number of samples not only of better and worse feeding grasses, but also of the soils and subsoils of the fields on which they grew.

It is scarcely possible to get a sample of grass that will represent the feeding quality of that which is eaten by stock, for not only do stock exercise a certain amount of selection in what they eat, but by their repeated cropping they alter the growth of the grass from week to week and consume it in a condition which cannot well be imitated. If it were to be imitated as nearly as possible, it would have to be done by cropping the grass from week to week during the grazing season, and performing a large number of analyses of each pasture under investigation. That was out of my power, but nevertheless it seemed to me that as a preliminary investigation it would be useful to obtain samples of grass from any two pastures in the same district which were known to possess different feeding qualities in any convenient way. Some of those who assisted me in this were good enough to enclose with a fence what seemed to be representative parts of the pastures, and provide me with well-grown samples of the grass. It was impossible to determine the amount of moisture in these samples, as they had to come from a considerable distance. They were therefore air-dried in the laboratory, and analyses were made of the hay derived from the pasture-grass; but as grass does not lose anything but moisture when carefully dried, the constituents found are precisely those which the grass contained in the green state.

The only conditions attached to the taking of samples were that the pastures should be as nearly as possible equally rough

and equally well relished by stock, and that they should be taken at the same time.

The first samples to be noticed were sent to me by Mr David Wilson, jun., of Carbeth. They were taken from three fields, marked 1, 2, and 3 in the order of merit—No. 1 being the best. Portions of the pasture were fenced off for the purpose, and the samples of grass were analysed by Mr Wilson in his own private laboratory, as well as by myself. The scheme of analysis was arranged by Mr Wilson, who has given special attention to the analysis of grass, and whose elaborate series of grass analyses are recorded in former volumes of the 'Transactions,' 1886 and 1889. The results of our analyses agreed very closely, and those obtained by me were as follows:—

TABLE I.—PASTURES FROM CARBETH.

	1	2	3
Crude protein (N × 6.25)	16.73	14.44	17.06
Containing albumen	11.37	11.37	12.25
" amides, &c.	5.36	3.07	4.81
Ether extract	3.75	2.10	2.20
Solids soluble in 1¼ per cent solution of sulphuric acid	44.40	44.70	44.65
Containing carbohydrates	28.86	30.90	31.45
" crude protein	7.54	5.25	7.00
" ash	8.00	8.55	6.20
Solids insoluble in 1¼ per cent solution of sulphuric acid, but soluble in 1¼ per cent solution of caustic potash	32.70	35.10	35.00
Containing carbohydrates	21.36	23.51	21.44
" crude protein	9.19	9.19	10.06
" ash	2.15	2.40	3.50
Woody fibre	21.50	18.30	19.85
Residual ash	1.40	1.90	.50
Total ash	11.55	12.85	10.20
Moisture	17.40	19.50	16.90

A few words of explanation are required in order that the analyses may be understood and conclusions drawn from the results.

By crude protein is meant the total nitrogenous matter of the grass, considered as consisting of albumen. It is a convenient term, and it is determined by discovering by analysis the total amount of nitrogen and multiplying that by 6.25. This crude protein consists partly of albumen and partly of amides and amido-acids; and besides these there are sometimes nitrates present in small amount, and also traces of other nitrogenous substances. The most important of these constituents is albumen, as it is from it that animals derive the material for the formation of flesh, nerve, sinew, and other nitrogenous tissues; and the amides also perform important

functions in assisting in the formations of these substances or in protecting them from waste. The ether extract contains whatever fatty, oily, or waxy substances there are in the grass, and also other substances of less value as food, such as the chlorophyll or green colouring matter of the grass.

The great mass of the vegetable matter of the grass consists of what are collectively called carbohydrates, substances somewhat of the nature of starch. In these analyses they appear under two heads—those which are soluble in a solution of 1¼ per cent sulphuric acid, and those which are insoluble in that, but soluble in a solution of 1¼ per cent caustic potash. It was thought probable that some information might be obtained by distinguishing the carbohydrates and also the crude protein and ash under these two heads.

The rest of the vegetable matter insoluble in these two solutions is classified as woody fibre. The relative values of these two classes of carbohydrates and the woody fibre are very imperfectly known.

The three analyses of grass given above differ very little from each other, but any little difference that there is would lead one to infer that No. 3 was better than the other two; nevertheless, Mr Wilson considers the field it was taken from as not quite so good as the others.

It is not necessary to conclude from this that chemical analysis affords no reliable indication of feeding value. It is probable that the method of analysis would require to be modified in some way so as to give additional information regarding the very numerous substances included under the name carbohydrates and woody fibre. Collectively they represent about three-fourths of the entire fodder, and although they are very similar in chemical composition, we see that they differ very much in their solubility in weak acid and weak alkali, and they may be composed of substances which contribute very differently to the nutritiousness of fodder, and in a way that is not made manifest by the method of separation employed in these analyses. The chemical processes that go on in the digestive apparatus of animals are exceedingly complex, and it is admitted that physiologists know very imperfectly the changes that carbohydrates and woody fibre undergo in the digestive tract of herbivorous animals, so that we are not in possession of methods of analysis to apply to fodders that can approximately imitate the act of digestion so as to enable us to draw fine distinctions regarding the nutritive effects of fodders that are very nearly allied to each other in chemical composition. The method employed in the above analyses is sufficient to enable us to determine the relative value of fodders when there is a marked difference in their feeding properties, but it is

probable that the differences between these three samples of grass are not sufficiently marked to enable us by the method of analysis employed to estimate their relative values. Nevertheless, the information supplied by these analyses may not be so deficient as at first sight appears.

We must keep in view that these are analyses of hay made from grass that was fenced in and permitted to grow to some length. It does not follow that fodder so grown will have the same composition or the same nutritive effect as grass which is constantly being cropped by grazing animals. The parts of the grass plants that are browsed by stock are not quite the same as those which make up the bulk of the hay. When grass is being constantly eaten the plants are mostly deprived of their flowering stem in its young state, and they spend the rest of the season in producing leaves, and these leaves have a very different feeding value from the stems and flowers which usually bulk so largely in hay. The grass at Carbeth was cut before flowering, and therefore approximated more closely to pasture-grass than it would have done had it been allowed to mature.

Seeing that the analyses of the hay did not convey the required information, it seemed probable that the analyses of the soils might afford a truer index of the value of the pasture grown on them. The soils and subsoils were carefully sampled by Mr Wilson, and on Table II. are the results of their analysis. The following was the method used: 100-gramme portions of the finely ground samples were dissolved in boiling strong nitric acid for half an hour. The liquid when cold was separated from the soil and made up to 500 cc., and this solution was used for determining the various ingredients in the usual manner.

By this method the whole of the nutritive ingredients in the soil are dissolved. It may be objected to this method that plants cannot utilise the whole of the substances so dissolved, and that it is only that proportion which is "available" or immediately assimilable by the roots of plants that determines fertility. Many attempts have been made to find a solvent that would imitate the solvent action of roots. Dilute mineral acids, weak acids such as carbonic acid and 2 per cent solution of citric acid, have been used. The most recent is a 1 per cent solution of citric acid, whose solvent action on phosphates was shown by Stutzer to correspond with their manurial efficacy. Mr Bernard Dyer recently adopted this solution, as it seemed to have some resemblance in its action to the solvent power of the root, and used it for dissolving the soils of some of the Rothamsted fields whose fertility was known. Upon the whole, he was led to the conclusion that a 1 per cent solution of citric acid, which dissolved only part of the phosphates in the soil,

gave a better indication of the relative fertility of soils—at least as regards their phosphates—than a solution made with strong acids which dissolved the whole of the phosphates.

I applied Mr Dyer's method to these soils, and the results are given in the following analysis, along with the total phosphoric acid:—

TABLE II.—SOILS AND SUBSOILS FROM CARBETH PASTURES.

	1		2		3	
	Soil, 1-9 in.	Subsoil, 9-18 in.	Soil, 1-12 in.	Subsoil, 12-20 in.	Soil, 1-12 in.	Subsoil, 12-20 in.
Moisture	3.31	3.51	3.30	2.57	2.26	.89
Organic matter	6.87	3.94	8.04	3.57	5.43	1.74
Containing nitrogen	.23	.06	.22	.08	.19	.03
" nitric acid	.005	.002	.008	.005	.006	.008
Phosphoric acid	.17	.09	.10	.06	.14	.07
Potash	.07	.17	.07	.11	.06	.13
Lime	.38	.24	.51	.19	.28	.17
Magnesia	.23	.24	.66	.64	.43	.37
Oxide of iron and alumina	4.15	6.14	3.97	5.04	3.19	2.08
Stones	17.24	3.78	3.07	2.27	13.06	10.62
Phosphoric acid soluble in 1 per cent solution of citric acid	.041	...	.024	...	.027	...

The constituents in a soil which are of most importance in determining its fertility are nitrogen, phosphoric acid, potash, and lime, and judging by the amount of these substances contained in the three soils, there need be no hesitation in selecting No. 1 as the most fertile, but whether No. 2 or No. 3 comes next is not so clear. The soil of No. 1 field is not so deep as the others, and ought not to contain so great a store of plant food, but its richness in phosphoric acid and also of nitrogen and potash are all in its favour. It is a characteristic of these soils that the subsoil is much richer in potash than the soil itself, and although the soils are deficient in potash, the soil and subsoil taken together have as great a store of potash as is found in ordinary fertile soils. Mr Wilson informs me that the application of potash manures has no appreciable effect on these pastures, but that is probably due to their deficiency in lime. Potash manures exert very little influence on soils deficient in lime. The proportion of lime in these soils is only about half what is found in ordinary fertile soils, and that is a defect that exerts its influence not so much in a restriction of the available store of lime, as such, required for the nourishment of the grass, as in the suppression of these processes in the soil by which

lime is indirectly effective in enabling the grass to utilise more perfectly the stores of nitrogen and potash contained therein.

There is another constituent which has a very important part to play in rendering soils fertile, and that is the organic matter. It is a very complex substance, and it is probable that the analysis of it may be of considerable value in determining the relative value of soils. We have here to do only with its amount; and it will be noticed that not only in the Carbeth soils, but in those which follow, fertility and richness in organic matter are very closely related to each other. In soils otherwise very similar, the one that has most organic matter up to a certain measure—that is to say, about 15 per cent—is the more fertile soil. A soil may have excess of organic matter, and be the worse for that; but if it does not exceed from 15 to 20 per cent its value is difficult to over-estimate, and its proximate composition deserves closer study than it has yet received from agricultural chemists. It will be noticed that the fertility of these soils runs pretty parallel with their respective richness in organic matter. The phosphoric acid got from the 1 per cent citric acid solution is pretty uniformly about one-fourth of the total phosphoric acid.

As none of Mr Wilson's fields were high-class feeding pastures, he asked Mr John Edmond, Gallamuir, Bannockburn, to send me from the policies of Dunmore samples of what are considered the best old pastures in Stirlingshire—viz., Nos. 4 and 5. No. 4 is the richer of the two, and is taken from a field reclaimed from the Forth, and therefore under sea-level. The soil is rich alluvium, and locally known under the name of "slike." Mr Edmond reckons that 1 acre and 30 poles of that pasture will feed and finish a bullock of 13½ cwt. live-weight before the end of the season. The land has been about fifty years in pasture, and has never been known to fail in feeding quality. No. 5 is from a field 20 feet above sea-level, a carse clay, which has been twenty years in pasture. Mr Edmond reckons that 1 acre 1½ roods of that pasture are required to feed and finish a bullock weighing 12½ cwt. The analyses of the two samples, cut at the same time, and also of the soil and subsoil of the fields they were cut from, were as in Tables III. and IV. (p. 416).

In this case, as in that of the grass and soils from Carbeth, the differences which we are endeavouring to discover by means of analysis are not very marked, nevertheless it is easily seen that, both as regards the grasses themselves and the soils on which they were grown, there are decided differences in favour of the fatter pasture. The crude protein in No. 4. is greater than that in No. 5, and the amount of true albumen is correspondingly great. There is also a greater amount of fatty matter in No. 4, while the carbohydrates and woody fibre are practically the same in both.

TABLE III.—PASTURES FROM DUNMORE POLICIES.

	4	5
Crude protein (N × 6.25)	13.31	12.60
Containing albumen	12.25	11.60
" amides, &c.	1.06	1.00
Ether extract	4.57	3.95
Solids soluble in 1¼ per cent sulphuric acid	50.00	52.00
Containing carbohydrates	37.63	40.84
" crude protein	5.87	4.16
" ash	6.50	7.00
Solids insoluble in 1¼ per cent sulphuric acid, but soluble in 1¼ per cent caustic potash	28.70	26.80
Containing carbohydrates	18.56	16.46
" crude protein	7.44	7.44
" ash	2.70	2.90
Woody fibre	20.10	19.90
Residual ash	1.20	1.30
Total ash	10.40	11.20
Moisture	12.80	12.00

TABLE IV.—DUNMORE SOILS AND SUBSOILS.

	4		5	
	Soil, 9 inches.	Subsoil, 9-18 inches.	Soil, 9 inches.	Subsoil, 9-18 inches.
Moisture	5.40	5.00	4.72	4.60
Organic matter	12.95	7.77	10.60	5.58
Containing nitrogen	.40	.23	.32	.14
" nitric acid	.007	.007	.007	.005
Phosphoric acid	.20	.22	.14	.11
Potash	.18	.32	.16	.26
Lime	.68	.62	1.03	.78
Magnesia	.95	1.19	.84	.88
Oxide of iron and alumina	7.13	8.62	4.66	6.84
Stones	4.41	.17	1.73	...
Phosphoric acid soluble in 1 per cent citric acid	.050	...	.030	...

As regards the soils and subsoils, No. 4 has the advantage of No. 5 in the three most important ingredients of plant food,—nitrogen, phosphoric acid, and potash, and also in organic matter. It will be noticed that the nitrogen present in these as in the former soils, in the state of nitric acid, is very small and does not differ very much. That is a transient constituent of the soil, and varies a good deal according to a variety of circumstances. The lime in No. 4 is less than that in No. 5, while the magnesia is greater—and that is an indication that the lime in No. 4 has been longer drawn upon than in No. 5. The quantity of lime in ordinary soils exceeds the mag-

nesia very considerably, and when the quantity of these two substances approximate to each other, and especially if, as in the case of No. 4, the magnesia preponderates, it is an indication that the land would be benefited by liming despite the fact that it contains as much lime as is usually found in fertile soils. The citric acid solution contains, again, about one-fourth of the total phosphoric acid in each case.

The next three samples of grass were obtained for me by Mr Milne, Mains of Laithers, from Careston. No. 6 is a sample of fine old grass from the Deer-park which has been in pasture for upwards of a century. Very few of the grasses in this field ever flower. As is the case with very old pastures that are well grazed, the grasses through constant cropping have lost the habit of flowering. The Drum Park, No. 7, is also a very old pasture, and though it grows plenty grass, it is nothing like so rich a feeding subject as the old Deer-park. Craigie's Muir, No. 8, is much younger, and though it grows a large amount of rough grass, it is considered a poor pasture (Tables V. and VI., p. 418).

The differences in these three samples of grass are very pronounced, and in such a case chemical analysis is quite a reliable guide to their relative feeding properties. It is chiefly in the proportions of albumen that they differ, and that is evidently the constituent of chief importance in determining the richness of a pasture.

It is remarkable how in these grasses, as in the former sets, the percentage of crude protein insoluble in dilute sulphuric acid, but soluble in dilute caustic potash, in all the samples is just about the same. The very small amount of woody fibre in the grass of the Deer-park is due to the fact that it consists almost entirely of the leafy part of the plant, while in the other two there are numerous flowering stems.

The analysis of the soils corroborates the evidence given by that of the grasses. The nitrogen, phosphoric acid, and potash, both in the soils and subsoils, are abundant in proportion as the pasture is richer as a fodder. In these pastures there is seen again the peculiarity observed in many old pastures that have not been limed—viz., that magnesia is more abundant in the soils and subsoils than lime. The animals that have been pasturing there for ages have taken the lime of the grass for the making of their bones, and have retained comparatively little of the magnesia. That constituent has been returned to the soil in their dung and urine, so that the soil which was once much richer in lime than in magnesia now contains a disproportionately large amount of the latter, and there is a clear indication that the application of lime would be very beneficial to all these pastures. The want of lime is their chief defect; and Nos. 7 and 8 are also deficient in potash.

TABLE V.—PASTURES FROM CARESTON.

	6 Deer Park.	7 Drum Park.	8 Craigie's Muir.
Crude protein (N × 6.25)	20.02	12.00	9.08
Containing albumen	14.44	8.97	6.90
" amides, &c.	5.58	3.03	2.18
Ether extract	3.75	2.40	2.45
Solids soluble in 1¼ per cent sulphuric acid	48.40	39.40	40.50
Containing carbohydrates	29.51	30.65	36.32
" crude protein	11.27	3.25	.33
" ash	7.62	5.50	3.85
Solids insoluble in 1¼ per cent sulphuric acid, but soluble in 1¼ per cent caustic potash	31.35	33.55	32.30
Containing carbohydrates	19.10	22.70	21.10
" crude protein	8.75	8.75	8.70
" ash	3.50	2.10	2.50
Woody fibre	17.25	26.05	26.00
Residual ash	3.00	1.00	1.15
Total ash	14.12	8.60	7.50
Moisture	15.30	12.90	13.90

TABLE VI.—SOILS AND SUBSOILS FROM CARESTON PASTURES.

	6 Deer Park.		7 Drum Park.		8 Craigie's Muir.	
	Soil, 1-6 in.	Subsoil, 6-12 in.	Soil, 1-6 in.	Subsoil, 6-12 in.	Soil, 1-6 in.	Subsoil, 6-12 in.
Moisture	4.18	2.48	4.05	3.19	2.82	2.23
Organic matter	13.62	5.47	12.06	8.25	7.66	4.96
Containing nitrogen	.52	.21	.43	.30	.26	.12
" nitric acid	.020	.013	.011	.017	.018	.011
Phosphoric acid	.35	.26	.24	.18	.14	.12
Potash	.16	.08	.09	.06	.09	.15
Lime	.27	.20	.25	.17	.16	.38
Magnesia	.41	.26	.47	.21	.55	.16
Oxide of iron and alumina	5.41	4.19	5.10	4.04	4.35	5.87
Stones	1.63	14.54	11.98	30.73	10.39	5.24
Phosphoric acid soluble in 1 per cent citric acid	.077	...	.055	...	.044	...

While visiting the local experiments in Aberdeenshire, I observed a field of fine old grass at Conglass, and I was informed by Mr Stephen that it was an exceptionally good feeding pasture. He also informed me that at Middleton of Balquhain, close by, there was what he believed to be very good land lying in grass, but not to be compared with his field for feeding quality. He was kind enough to procure for me samples of the grass and of the soil from both pastures in

1892, and again last year. The following are the results of the analysis of the samples of both years:—

TABLE VII.—PASTURES FROM CONGLASS AND BALQUHAIN.

	9 Conglass.		10 Middleton of Balquhain.	
	1892.	1893.	1892.	1893.
Crude protein (N × 6.25)	19.03	12.90	6.30	7.87
Containing albumen	12.25	10.06	4.59	6.12
" amides, &c.	6.78	2.85	1.71	1.75
Ether extract	3.00	3.05	2.20	2.75
Solids soluble in $1\frac{1}{4}$ per cent sulphuric acid	46.40	51.05	45.85	42.55
Containing carbohydrates	25.33	38.58	38.20	33.12
" crude protein	10.72	5.47	2.80	3.93
" ash	10.35	7.00	4.85	5.50
Solids insoluble in $1\frac{1}{4}$ per cent sulphuric acid, but soluble in $1\frac{1}{4}$ per cent caustic potash	28.25	23.10	24.55	26.30
Containing carbohydrates	17.04	12.66	16.65	19.11
" crude protein	8.31	7.44	3.50	3.94
" ash	2.90	3.00	4.40	3.25
Woody fibre	19.20	23.40	28.30	28.80
Residual ash	6.15	2.00	1.30	2.00
Total ash	19.40	12.00	10.55	10.75
Moisture	17.40	12.76	14.10	12.55

TABLE VIII.—SOILS AND SUBSOILS FROM CONGLASS AND BALQUHAIN.

	9 Conglass.		10 Middleton of Balquhain.		
	Soil, 1-6 in.	Subsoil, 6-12 in.	Soil, 1-6 in.	Subsoil, 6-12 in.	Pan, below 18 in.
Moisture	2.52	3.26	5.02	2.75	4.74
Organic matter	5.49	7.48	10.46	4.30	10.15
Containing nitrogen	.17	.28	.36	.19	.28
" nitric acid	.009	.005	.009	.002	.006
Phosphoric acid	.30	.28	.45	.30	.43
Potash	.08	.09	.09	.09	.10
Lime	.64	.40	.46	.43	.41
Magnesia	.52	.59	.45	.28	.46
Oxide of iron and alumina	7.03	7.01	9.02	7.59	8.86
Stones	11.43	8.20	7.03	21.39	11.37
Phosphoric acid soluble in 1 per cent citric acid	.070	...	.092	...	...

The analysis of the grass leaves no doubt as to which pasture is the better. The grass at Conglass contains double the proportion of albumen and much less woody fibre. It was a strong leafy grass. The grass at Balquhain was fenced off,

but it did not make much growth despite the protection afforded it. A peculiarity of this grass, which no doubt accounts for its inferior feeding quality to some extent, was the entire absence of clover. The farm of Middleton of Balquhain does not grow clover. It grows abundant crops of turnips and corn, but it is a peculiarity of the land that it lies upon a stiff pan, and the aeration and free drainage of the subsoil are thereby hindered. The want of ventilation and the retention of products filtered down from the soil and subsoil, which are absolved by the pan and remain there in an unoxidised state, have disadvantages which are peculiar, and until these are removed by the breaking up of the pan mere chemical analysis to determine the proportion of the elements of fertility will not give reliable information. Deep-rooting plants, such as clover, are at a disadvantage in such a soil, for as soon as they reach the sour unventilated pan they not only cease to grow, but they absorb unoxidised materials which act as a poison to the plant. I am informed that the turnips grown on this soil have to be fed to cattle in very moderate quantity, otherwise they purge excessively. It is evident that in this case we have to deal with a subtle constituent requiring special investigation.

It is seen from the analysis of the soil and subsoil that they are rich in the elements of fertility. The soil is richer than the subsoil, as we should naturally expect; but the extraordinary feature of this soil is that the pan at a depth of 18 inches is also richer in the elements of fertility than the subsoil immediately above it. There is a store of fertility lying in that pan, but it is not able to be utilised by the crops grown. Only such crops as are content with what nourishment is contained in the first 12 inches of soil can grow there.

If they reach the pan and grow into it, they seem to find there some ingredient that either checks their growth or destroys them, and which contributes to the plant some irritant substance that renders the fodder unsuitable for feeding. It seems probable that if the pan were thoroughly broken up and disintegrated by ventilation and free drainage, the soil of Middleton of Balquhain, and the grass grown on it, would be enormously improved, and we should then have the analysis of the grass and the soil affording a more accurate gauge of feeding quality and fertility. Here again nearly one-fourth of the phosphate is soluble in the citric acid solution, and the soluble phosphate simply corroborates the total phosphate. It is interesting to note the difference in the analysis of the grass grown in 1892 and 1893 at both places, seeing that the two seasons differed so much. The summer of 1892 was a dull cold season, while that of 1893 was hot and dry.

The effect of these two different conditions is seen in the

actual and also the relative proportions of albumen and amides. At Conglass, during the dull cold summer, fully one-third of the crude protein consisted of amides, or other non-albuminoid substances of an immature kind. There was a want of sun to develop them into albumen. In 1893 less than one quarter of the crude protein consisted of these substances. The total percentage of crude protein was less, but that is because of the greatly increased proportion of carbohydrates and woody fibre made during the sunny summer—viz., 51¼ per cent carbohydrates as against 42⅛ per cent, and 23.4 of woody fibre as against 19.2 per cent.

At Middleton of Balquhain the proportion of albumen to amides was also greater in the hot year, but the drought evidently told more severely on the grass of that farm owing to the impenetrability of the pan, and there was not the same increase of carbohydrates as in the grass at Conglass.

The next samples, obtained last year, are five from Aberdeenshire, which were procured for me by Mr Milne, Mains of Laithers, who is much interested in this investigation. No. 11 is from a piece of fine old pasture at Mill of Fintray, near the bank of the Don, which has been depastured with sheep; No. 12 is from a fenced-in portion of the same soil; No. 13 is from the park in the policy of Dunecht, which grows a mass of sheep's fescue and fog; Nos. 14 and 15 were taken from a four-year-old pasture at Thaniston, Kintore, which is said to be somewhat inferior in feeding quality (Tables IX. and X., p. 422).

The grass from both Mill of Fintray and Thaniston is seen to be of very good quality, and it is instructive to notice the difference in the composition of the two samples taken at these places under different conditions.

The sample taken from the depastured portion of the field at Mill of Fintray has a high percentage of crude protein, but only about two-thirds of it consists of albumen, while in the portion fenced off fully three-fourths of the protein is albumen. The explanation is that the depastured grass was not allowed to flower nor to grow to maturity, it was constantly being bitten over. It consisted of highly nitrogenous, leafy substance, whose amides, &c., had not had time to be converted into albumen. The fenced-off grass, on the other hand, was allowed to grow its flower-stalks and to mature its seed, so that the amides, &c., were for the most part converted into albumen; but the presence of a considerable proportion of stalks had the effect of increasing the proportion of woody fibre.

The greater percentage of moisture in the air-dried grass from the depastured part of the field is also due to the greater tendency of the leaf to absorb and retain moisture.

TABLE IX.—PASTURES FROM MILL OF FINTRAY, DUNECHT, AND THANISTON.

	Mill of Fintray.		Dun-echt.	Thaniston.	
	11 Depas-tured with sheep.	12 Fenced.	13 Ne-glected.	14 Fenced. 1st cut Sept.	15 June. 2d cut Oct.
Crude protein (N × 6.25)	17.28	13.12	8.31	17.06	14.66
Containing albumen	11.37	10.06	6.12	11.81	11.81
" amides, &c.	5.91	3.06	2.19	5.25	2.85
Ether extract	3.35	2.90	3.75	2.65	3.50
Solids soluble in 1¼ per cent sulphuric acid	58.20	47.45	44.55	50.55	52.50
Containing crude protein	10.28	6.56	3.06	11.37	6.79
Solids insoluble in 1¼ per cent sulphuric acid, but soluble in 1¼ per cent caustic potash	19.30	24.96	25.30	23.25	24.80
Containing crude protein	7.00	6.56	5.25	5.69	7.87
Woody fibre	18.30	22.30	28.60	24.60	21.80
Total ash	12.10	14.45	7.70	11.25	9.95
Moisture of air-dried grass	16.95	13.78	13.33	14.63	14.46
Moisture in fresh grass (Milne)	...	...	63.14	75.78	77.49

TABLE X.—SOILS FROM MILL OF FINTRAY, DUNECHT, AND THANISTON.

	Mill of Fintray.	Dunecht.	Thaniston.
	Soil.	Soil.	Soil.
Moisture	3.25	2.26	3.11
Organic matter	7.00	6.46	9.52
Containing nitrogen	.25	.21	.33
" nitric acid	.008	.003	.004
Phosphoric acid	.28	.12	.28
Potash	.19	.09	.13
Lime	.51	.23	.23
Magnesia	.99	.31	.32
Oxide of iron and alumina	7.7	2.58	4.81
Stones	.05	13.24	9.7
Phosphoric acid soluble in 1 per cent citric acid	.046	.034	.060

The grass at Thaniston did not show by its analysis that it was of inferior feeding quality, and another sample of it was cut about six weeks later. The difference in the analysis of the two portions is similar to that of the two samples from Mill of Fintray, and due also to the same cause—viz., the greater preponderance of leaf, or I should rather say the almost entire absence of flower-stalks in the sample that had been cut over. But it must be confessed that samples 14 and 15 do not convey

the impression that the grass is of inferior quality. On the contrary, it has all the appearance of being very good feeding grass. I am therefore unable to accept the statement that it is a poor pasture. I rather think a hasty judgment has been passed upon it. It is only four years old, and therefore it has not had time to acquire a character either for poverty or richness, and during the second and third year it would probably be at its worst. Properly speaking, it should not have been included among those analyses, as it has not yet acquired the character of permanent pasture.

The pasture at Dunecht is of a very poor description. No attempt is being made at present to maintain the grass as a pasture, and it is rapidly falling back into a state of wilderness.

The soils of these pastures tell by their analyses the same story as the grasses. That of Mill of Fintray is a fine alluvial soil with scarcely a stone in it. Thaniston soil is rich in organic matter for so young a pasture, and had probably been well dunged before it was put down to grass. That of Dunecht is about 12 inches deep, resting on a stiff yellow clay. It is somewhat deficient in potash, lime, and phosphoric acid; but what it needs most, so as to grow good grass, is management. The proportion of phosphate soluble in 1 per cent citric acid is one-sixth in the case of Mill of Fintray, and about one-fourth in the other two.

The only other pastures examined were two from Mr Andrew M'Gill, Kildonan, supplied at the request of Mr Hunter, Secretary to the Stoneykirk Analytical Association, Wigtownshire—viz., No. 16 and No. 17. They are both taken from the same field, and are samples of first year's grass which was cut from portions fenced off for the purpose. In former years Mr M'Gill noticed that that part of the field from which sample 16 was taken was the part of the field eaten barest by his cows, while No. 17 was taken from the part of the field that was last to be eaten. There was no apparent difference in the quantity of grass and clover on the two fenced-off parts, and the fact that it was first year's grass, and rich in clover, accounts for the large amount of protein. The soil is not more than 7 inches deep, and it is not a particularly good pasture at any time. The grass was sown out with an oat crop after turnips, to which 10 cwt. bone-meal and 3 cwt. superphosphate had been applied, and which were half-eaten on the ground by sheep. It would have been a better test if the grass had been some years old, but they were the only samples of grass got from that district.

They are not very different in most respects. The chief difference lies in the superiority of No. 16 in albumen, which we have seen is a very important item. The fatty matter—wax and chlorophyll—is also more abundant in that grass, and the

woody fibre is comparatively low. The soil of No. 16 is also richer in nitrogen than the other, but the chief difference is the great abundance of stones in the soil of that field. That excess of stones means a corresponding reduction in the percentage of all the other constituents of the soil, so that if the soils were riddled and only the fine soil taken, the elements of fertility in No. 16 would be considerably increased. It is a common error made in the analysis of soils to ignore the stones and describe the ingredients contained in the fine sample only.

TABLE XI.—Grass from Field at Kildonan.

	16	17
Crude protein (N × 6.25)	18.59	15.09
Containing albumen	12.69	10.50
" amides, &c.	5.90	4.59
Ether extract	2.25	1.80
Solids soluble in 1¼ per cent sulphuric acid	47.15	46.40
Containing protein	9.40	8.09
Solids insoluble in 1¼ per cent sulphuric acid, but soluble in 1¼ per cent caustic potash	26.75	24.90
Containing protein	9.19	7.00
Woody fibre	23.40	25.60
Total ash	10.25	11.20
Moisture	15.55	15.15

TABLE XII.—Soils from Field at Kildonan.

	16 Soil.	17 Soil.
Moisture	3.17	2.57
Organic matter	11.72	7.70
Containing nitrogen	.30	.25
" nitric acid	.004	.005
Phosphoric acid	.18	.20
Potash	.18	.16
Lime	.44	.49
Magnesia	.56	.72
Oxide of iron and alumina	5.10	5.04
Stones	19.72	8.35
Phosphoric acid solution in 1 per cent citric acid	0.58	0.46

In all the preceding analyses the stones have been reckoned as a constituent of the soil, reducing by their presence the area of the soil capable of yielding nourishment to the pasture. Despite the prevalence of stones, the organic matter in No. 16 is far ahead of that in No. 17, and it is probable that when the grass is a few years old a very different kind of grass will be

found growing on the more barely eaten portion. In this case, for the first time, there is seen the advantage which the citric acid solution has over the other as an indicator of the relative fertility. No. 17 has more total phosphoric acid than No. 16; but despite its greater quantity it is less available as a nourisher of the grass. It would seem, therefore, that a 1 per cent citric acid solution of a soil affords additional information as regards the phosphates of the soil in some cases, and is a useful aid to diagnosis.

The conclusions to be drawn from this investigation are that, except in cases where the difference in the feeding value of pastures is very slight, the chemical analysis of the grass by the methods here employed affords fairly reliable information, and that information is increased and made still more reliable by the analysis of the soil. Further, it is probable that if we could get what might be regarded as a fair sample of that portion of the grass which is really eaten by stock, any slight discrepancies such as have been noted might disappear. There is some additional information derivable from the separate estimation of the protein, and perhaps also of the ash contained in that portion of the grass that is soluble in a weak solution of acid and that which is not; but it would require a larger induction than what is here afforded to draw any definite conclusion regarding that point. It is probable also that the separation of the carbohydrates into various classes may yet provide useful information in the way of gauging the feeding value of fodders; but so far as they go, it is evident that both the analysis of the grass itself and of the soil by our present methods are very useful guides in enabling us to form a fairly accurate estimate of the relative feeding value of pastures that are apparently equally productive of grass. It need hardly be said that the feeding value of a pasture per acre depends on the quantity as well as the quality of the grass it produces; and it is only in cases where the same quantity per acre of grass is grown that the analysis of the grass affords an indication of the feeding value of a pasture. The only two pastures whose relative feeding quality has been accurately gauged for this inquiry are Nos. 4 and 5; but even in that case the actual amount of grass produced on each pasture may differ considerably. The quality of the grass does not differ much from that grown at Carbeth, but there can be no doubt that the quantity is much greater. The analyses of the soils at Dunmore show that they contain a far larger store of plant food than those at Carbeth; and in the case of old-established pastures it is the amount of plant food in the soil rather than the kind and quality of the grass that affects their feeding value.

THINNING OF TURNIPS AS AFFECTING THE QUANTITY AND QUALITY OF THE CROP.

A small preliminary experiment carried out in 1892 (see 'Transactions,' 1893, pp. 320-327) pointed to the conclusion that when turnips were grown closely in the drills they were sweeter and better matured than those grown widely, and the results were altogether such as to make it desirable to test the matter on a larger scale. The question to be answered was, "By what method of thinning is it possible to grow the greatest weight and best quality of turnip food per acre?" The experiment was carried out by

Mr Shirra Gibb, Boon, Lauder.
Mr Milne, Mains of Laithers.
Mr Ferguson, Lessendrum, Huntly.
Mr Barron, Meikle Endovie, Alford.
Mr Walker, Westside, Kildrummy.

Mr Shirra Gibb tested the question on two fields and by means of duplicate experiments; Mr Milne tried it on a field of yellow turnips and on one of swedes; and Mr Ferguson on a larger scale on a field of yellow turnips.

Each plot consisted of three drills of length varying from 34 to 60 feet. The middle drill of each plot was selected for weighing, and the results of the weighing are summarised on Table I.

TABLE I.

No. of plot.	No. of plants.	Width.	Average width per plant.	Boon.		Laithers.		Lessendrum.	Average.
				Wellfield. Yellows.	Crofts. Yellows.	Yellows.	Swedes.	Yellows.	
		in.	in.	tons.	tons.	tons.	tons.	tons.	tons.
5	2	3	$1\frac{1}{2}$	25.7	27.1	18.3	25.7	23.6	25.1
9	4	9	$2\frac{1}{4}$	22.6	21.4	20.2	25.7	22.7	22.5
1	1	3	3	21.6	23.1	19.7	26.8	24.4	23.1
6	2	6	3	23.8	23.4	23.3	25.5	28.1	24.8
8	3	4	3	24.5	23.1	23.3	27.2	23.4	24.3
10	4	12	3	21.7	20.0	19.7	26.4	20.6	21.7
7	2	9	$4\frac{1}{2}$	23.0	20.8	24.9	24.9	26.2	24.0
2	1	6	6	20.3	20.6	20.5	25.2	23.6	22.0
3	1	9	9	18.9	18.6	22.6	27.7	23.5	22.2
4	1	12	12	18.7	18.4	24.8	27.1	26.6	23.1

There were in all ten plots thinned as follows: one plant left every 3 inches, one every 6 inches, one every 9 inches, and one every 12 inches; also two plants every 3 inches, two every 6 inches, and two every 9 inches; also three plants every 9 inches; and lastly, four plants every 9 inches and every 12 inches. The plants are arranged on Table I. according to the average width per plant, beginning with the closest planting—viz., $1\frac{1}{2}$ inches—and ending with the widest—viz., 12 inches. It was expected that very considerable differences in the weight per acre of bulbs grown would be observed in passing from the closely to the widely thinned plants, but it will be seen from the table that there is no very great difference.

The answer to the first part of the inquiry is given in that table, at least so far as the circumstances affecting the crop of 1893 are concerned. One is tempted to conclude from these results that it is a matter of indifference at what distance turnip plants are grown between 3 and 12 inches, so far as the bulk of the crop is concerned. There would seem to be a certain amount of fertility or strength in the land for the growth of turnips, and the rooting power of the crop would seem to be much about the same whether composed of many small turnips or comparatively few large ones. Upon the whole the advantage seems to lie with the more closely planted plots, but it is evident from the somewhat erratic character of the results obtained in different fields that it would be unsafe to make an absolute statement of that kind.

If we limit our attention to the results obtained on the two fields at Boon, we might consider that a sound inference, for they corroborate each other very well, and the results are also in conformity with those obtained on the same farm during the former season. I had the opportunity of inspecting the crops, and was present at the weighing. The crops as they stood on the ground formed a most interesting picture. They had been thinned in a manner which left nothing to be desired, and the single bulbs, the pairs, the triplets, and the clumps of four each occupied their places with wonderful regularity and uniformity, so that reliance may be placed on the accuracy of the results. I cannot but believe that so far as Boon farm is concerned, and the climatic conditions under which the crops were grown, we have in these figures the proof that close planting is more favourable to the production of a heavy crop than wide planting. The closest planted of all—viz., that in which two plants were left every 3 inches—has yielded by far the heaviest crop. The bulbs resembled good-sized apples, and were not such as would be likely to please the eye of a farmer. Many of them, of course, were very small; and although when freshly pulled they were good juicy bulbs, they shrivelled up a good deal on

keeping, and it became evident that at the end of the winter they would not weigh more than the crop of plots 1, 6, 8, and 10 that had twice as much room to grow in. If we compare these four plots, we see that two plants left every 6 inches and three plants left every 9 inches are better than a single plant every 3 inches or a clump of four every 12 inches. When two plants are left every 6 inches the bulbs attain a fairly good size; and although they have only an average extent of 3 inches in a straight line of the drill allotted to them, they grow in a zigzag manner along the drill, overlapping each other and attaining a diameter of 4 or 5 inches. Clumps of four plants do not make so regular a crop. They are evidently hampered, and one of the four is not unfrequently crushed out. Boon farm lies high, and these turnips were grown at an elevation of 900 feet above sea-level. At such an altitude it is probable that when two plants are left together, and pretty closely planted, they afford each other mutual protection; and it may be to that circumstance that is due the superiority of the closely planted plots over plots 3 and 4, where single plants were left at 9 and 12 inches respectively. As regards plot 4, it is of importance to record that though the bulbs grown on it were the largest and what would be regarded as most respectable in appearance, they stood the winter worse than the others. A section of the experimental plots was left out in the drills over the winter, and a very large proportion of the turnips on plot 4 rotted away.

As regards the crop of yellows at Mains of Laithers, which enjoys a mild climate and is not far above sea-level, it stands in marked contrast to that at Boon. The closest planted plots gave the lowest return, while the widest planted gave nearly the highest. On the whole, however, the evenest crop was grown on plots 6 and 8, as was the case at Boon.

The crop of swedes at Mains of Laithers was a very even crop over all the plots, and though the widest planted were the heaviest, they were practically on a par with plot 8, where three plants were left every 9 inches.

At Lessendrum, where the test was made on a larger scale than at the other places, the amount of crop grown was fairly uniform; but upon the whole the advantage lay with the more closely singled plots, if we except plot 10, where the plants were left in clumps of four planted 12 inches apart.

Gathering up the whole results at these farms, plots 5, 6, and 8 take the lead, and of these the latter two have given upon the whole the most uniform result; but, as already remarked, the differences are not so great nor the uniformity so marked as to entitle us to draw a definite conclusion as

to which is the width of planting that gives the heaviest crop.

There is one circumstance that deserves to be recorded in this place. There was an almost universal prevalence of mildew on the turnips in the north last season. It passed off without doing any permanent damage, but it was observed that where the turnips were planted closest the mildew was worst, and where they were widely planted there was almost no mildew. It would seem that a want of ventilation favoured mildew. It may seem absurd to speak of a want of ventilation in an open turnip-field, but I am quite convinced that the greater size of turnips that are standing apart is due not only to the greater amount of feeding-ground they enjoy, but also to their free ventilation; and all down an exposed drill on the windward side of a plot turnips grow better than in an exposed drill on the leeward. Mr Milne relates that in 1852 the turnips on his farm were severely attacked by mildew, so that the entire crop of a field lost their leaves, with the exception of one drill in the middle of the field where the neighbouring drill had been missed in sowing.

To test the quality of the turnips thinned at different distances samples of twelve turnips from each plot were sent by the experimenters, and as I was anxious to give this part of the investigation a thorough trial I analysed in all 60 sets of turnips. The results are given in Tables II. to V. (pp. 430-433).

The analyses made of the turnips grown under the conditions of this experiment in the former year led to the expectation that as regards the amount of solid matter—the relative proportions of albumen and amides, and the proportion of ready-made sugar—there would be noticed certain well-defined differences, according as the plants were closely or widely thinned.

It may be said, in a word, that these expectations have not been realised. That there are differences of the kind expected is true enough, but they are altogether so slight as not to be of any practical importance. The small closely-grown turnips were just as sappy as the big widely-grown ones, and the considerable differences noticed in some cases are due to what may be called accident, so far as this experiment is concerned—the accident of seed or of growth. Two turnips grown side by side on the same plot may vary in composition as much as any two from different plots do; and although these analyses were in most cases made from a dozen bulbs selected as fairly representing the growth in each plot, that number was not large enough to provide a completely representative analysis of the plot, and it would be very unsafe to trust to the analytical results so far as to multiply them into the quantities per acre of the different ingredients grown under conditions of close and wide thinning.

TABLE II.—Analysis of Yellow Turnips grown at Boon, Lauder.

No. of Plot	5	9	1	6	8	10	7	2	3	4
Average width of plants	1¼ in.	2¼ in.	3 in.	3 in.	3 in.	3 in.	4½ in.	6 in.	9 in.	12 in.
Water	88.71	86.94	88.79	89.10	88.27	87.78	87.94	87.09	88.70	88.66
Solids *	11.29	13.06	11.21	10.90	11.73	12.22	12.06	12.91	11.30	11.34
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Albumen	5.91	4.16	6.12	5.25	4.81	4.16	5.69	5.03	4.16	5.25
Amides, &c.	1.75	2.40	3.50	2.19	2.19	3.50	1.31	3.28	4.15	1.97
Carbohydrates, &c.	77.14	79.89	73.88	77.61	78.05	78.34	78.95	76.94	76.44	78.03
Woody fibre	8.95	8.00	8.90	8.75	8.90	7.90	8.40	8.25	8.95	8.25
Ash	6.25	5.55	7.60	6.20	6.05	6.10	5.65	6.50	6.30	6.50
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
* Containing sugar	5.5	5.9	5.0	5.8	5.3	6.4	5.9	5.1	5.3	5.0

TABLE III.—ANALYSIS OF YELLOW TURNIPS GROWN AT MAINS OF LAITHERS.

No. of Plot	5	9	1	6	8	10	7	2	3	4
Average width of plants	1½ in.	2¼ in.	3 in.	3 in.	3 in.	3 in.	4½ in.	6 in.	9 in.	12 in.
Water	91.10	91.97	91.58	92.36	92.11	92.01	92.69	92.86	91.91	91.27
Solids *	8.90	8.03	8.42	7.64	7.89	7.99	7.31	7.14	8.09	8.73
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Albumen	10.06	7.00	8.31	7.22	7.87	7.87	9.19	11.59	9.41	7.22
Amides, &c.	1.31	3.94	1.75	2.62	3.50	3.50	2.18	1.53	3.71	2.84
Carbohydrates, &c.	62.73	67.16	68.84	70.46	68.88	68.86	64.13	61.38	65.43	69.09
Woody fibre	15.65	12.70	12.40	11.50	10.95	11.37	15.35	15.00	12.00	12.25
Ash	10.25	9.20	8.70	8.20	8.80	8.40	9.15	10.50	9.45	8.60
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
* Containing sugar	6.2	4.6	5.1	5.0	5.1	5.7	5.5	4.9	5.1	5.2

TABLE IV.—ANALYSIS OF SWEDES GROWN AT MAINS OF LAITHERS.

No. of Plot	5	9	1	6	8	10	7	2	3	4
Average width of plants	1½ in.	2¼ in.	3 in.	3 in.	3 in.	3 in.	4½ in.	6 in.	9 in.	12 in.
Water	90.34	90.17	90.74	90.29	90.76	89.75	91.30	91.18	91.23	90.75
Solids*	9.66	9.83	9.26	9.71	9.24	10.25	8.70	8.82	8.77	9.25
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Albumen	9.41	9.19	8.97	8.97	10.72	8.75	9.84	9.62	9.84	8.53
Amides, &c.	2.40	3.28	2.84	2.19	2.84	3.50	2.41	3.29	3.07	2.63
Carbohydrates, &c.	59.24	63.73	65.64	69.39	59.99	70.00	57.90	64.04	65.04	69.99
Woody fibre	22.50	16.65	16.00	12.75	19.15	11.60	22.75	15.75	15.25	12.60
Ash	6.45	7.15	6.55	6.70	7.30	6.15	7.10	7.30	6.80	6.35
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
*Containing sugar	...	7.0	6.5	6.6	7.0	7.0	6.9	6.4	6.6	6.8

TABLE V.—ANALYSIS OF YELLOW TURNIPS GROWN AT LESSENDRUM.

No. of Plot	5	9	1	6	8	10	7	2	3	4
Average width of plants	1½ in.	2¼ in.	3 in.	3 in.	3 in.	3 in.	4½ in.	6 in.	9 in.	12 in.
Water	92.04	92.85	92.76	92.69	91.46	92.00	93.20	90.24	93.24	92.34
Solids *	7.96	7.15	7.24	7.31	8.54	8.00	6.80	9.76	6.76	7.66
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Albumen	8.31	8.53	7.87	8.31	8.09	7.66	10.94	6.12	10.28	9.84
Amides, &c.	2.85	1.97	3.50	5.03	3.50	1.96	4.37	2.63	2.63	2.41
Carbohydrates, &c.	63.99	62.35	63.28	62.81	66.41	67.03	57.44	70.50	59.09	62.35
Woody fibre	14.75	17.95	15.15	12.30	12.50	14.55	15.40	11.80	16.80	15.70
Ash	10.10	9.20	10.20	11.55	9.50	8.80	11.85	8.95	11.20	9.70
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
* Containing sugar	5.0	5.9	5.0	4.5	5.3	5.1	4.4	5.6	5.4	5.1

The fine warm sunny summer of 1893 enabled both large and small turnips to ripen completely, and convert the great mass of their carbohydrates into sugar. Sugar-beets grown on a number of farms in Lauderdale produced as large a percentage of sugar as is found in the crops of sugar-beet grown on the Continent.

If we could but have a continuance of summers such as 1893, sugar-growing would become a profitable industry in this country. But it is during dull backward seasons that the differences between closely and widely planted turnips are apparent, where the conditions for ripening are in favour of the smaller bulbs. During last summer it did not seem to matter how closely or how widely turnips were thinned, the results, as regards both quantity and quality, were very little affected thereby.

TABLE VI.

Meikle Endovie, Alford.								Westside, Kildrummy.	
			Yellows.			Swedes.		Yellows.	
No. of plot.	No. of plants.	Width of plants.	No. of bulbs per plot.	Weight per acre, Dec.	Weight per acre, April.	No. of bulbs per plot.	Weight per acre.	No. of bulbs per plot.	Weight per acre. Dec.
		in.		tons.	tons.		tons.		tons.
5	2	3	210	20.2	16.5	270	16.5	213	26.7
9	4	9	220	20.7	15.4	220	15.8	186	21.6
1	1	3	176	20.2	12.1	163	20.8	160	26.4
6	2	6	169	20.7	17.0	165	15.0	162	24.7
8	3	9	170	21.4	17.1	162	17.8	167	26.6
10	4	12	173	20.7	19.0	175	17.5	160	23.5
7	2	9	126	20.8	15.5	113	13.5	120	28.9
2	1	6	96	21.0	17.1	90	18.4	92	23.5
3	1	9	67	20.0	15.2	59	16.5	61	20.1
4	1	12	52	21.8	16.2	52	18.6	48	21.2

On Table VI. are given the results of the thinning experiments made by Mr George Barron, Meikle Endovie, Alford, and Mr James Walker, Westside, Kildrummy. They quite corroborate the general results obtained elsewhere. Mr Barron allowed the half of each plot of his yellow turnips to remain unprotected in the drills during winter, with the result that a considerable shrinkage took place. He explains, however, that although the bulbs remained healthy, they suffered somewhat from the attentions of crows and wood-pigeons. The sugar in these turnips was estimated, showing the same high percentage that was found in all the other instances; but like them, showing no difference

in the percentage found in the closely thinned from those in the widely thinned plots. The swedes show a greater percentage of sugar than the yellows; and yellows grown at a high elevation, as at Kildrummy, are not so rich in sugar as those growing lower down. They were as follows:—

TABLE VII.—PERCENTAGE OF SUGAR.

	MEIKLE ENDOVIE.		KILDRUMMY.
No. of Plot.	Yellows.	Swedes.	Yellows.
5	5.1	7.2	5.2
9	5.6	7.2	4.3
1	5.3	7.5	5.1
6	5.8	7.5	4.9
8	5.9	6.5	5.1
10	5.9	7.6	4.4
7	5.8	7.5	4.4
2	5.6	7.1	4.8
3	5.8	7.6	5.2
4	4.8	7.5	5.0

THE ECONOMICAL MANURING OF THE TURNIP CROP.

BEING THE RESULT OF FIELD EXPERIMENTS IN BANFFSHIRE IN 1893.

EXPERIMENT VIII. C.

A representation having been made to the Society by a number of the leading farmers in Banffshire to have an experiment tried in the county which would yield useful information in regard to the manuring of the turnip crop, the following Experiment (VIII. C.) was selected by them, and carried out in the four representative agricultural districts of the county—viz., the Central district; the Spey, Avon, and Fiddichside district; the Boyndie or Portsoy and Cullen district; and the Enzie district. The object of the experiment is to find the most efficient and least expensive turnip manure, and it resolves itself into three distinct questions, viz.:—

1. What are the relative merits of three forms of phosphate —viz.: fine bone-meal, superphosphate, and slag when applied along with nitrate of soda?

2. What proportion should the nitrate bear to the phosphate?
3. Has sulphate of ammonia any advantage over nitrate of soda?

The size of plot which experience has shown to be most appropriate for such an experiment is the fortieth of an acre, and nine plots sufficed for the purpose, manured as follows:—

Plot.	Quantities of Manure.	Per plot. lb.	oz.	Per acre. cwt.	Cost per acre. s.	d.
1.	Fine bone-meal	11	3	4	=26	0
	Nitrate of soda	0	11	$\frac{1}{4}$		
2.	Superphosphate	16	12	6	=26	0
	Nitrate of soda	2	13	1		
3.	Thomas-slag	25	0	9	=26	0
	Nitrate of soda	2	13	1		
4.	Mixed super and slag	21	0	$7\frac{1}{2}$	=26	0
	Nitrate of soda	2	13	1		
5.	Mixed super and slag	21	0	$7\frac{1}{2}$	=35	0
	Nitrate of soda	5	10	2		
6.	Fine bone-meal	11	3	4	=26	0
	Sulphate of ammonia	0	9	$\frac{1}{5}$		
7.	Superphosphate	16	12	6	=26	0
	Sulphate of ammonia	2	4	$\frac{4}{5}$		
8.	Mixed super and slag	21	0	$7\frac{1}{2}$	=17	0
9.	Nothing	...		...	...	

The value of experiments of this kind depends on the care that is taken to have every detail carefully carried out and checked in such a manner as to reduce to a minimum the risk of error in selecting the ground, measuring it, applying the manures, weighing the crops, and noting the results. Every care was taken to achieve success in these particulars. Every experimenter was supplied with a printed schedule giving instructions regarding all details, and for tabulating the results. Each district in which an experiment was carried out was superintended by a secretary, and the local experimenters mutually assisted in witnessing and checking each other's results.

It is the first time that such an experiment has been undertaken in Banffshire, and I am able to state, from personal investigation and inspection on the spot, that the work was done in a most careful and accurate manner, so that the results obtained are as reliable as the results of field experiments can be. There are a few failures to record, due to causes which were beyond the control of the investigators; but the number of successes is so great as to command perfect confidence. There were in all forty successfully completed tests, and these are noted in the tables at the end of this paper. They are of individual interest to the experimenters themselves, and to those farming in the districts; but as the average results are alone of interest to the general reader, I will give them first, and sum-

marise the lessons that these experiments have taught us (see Tables I.-V., pp. 443-447).

From this summary are excluded a certain number that are recorded in the district tables, but which, owing to attack of insects, prevalence of disease, or other inevitable causes, have had their accuracy impaired to some extent.

Before drawing any conclusions from these results, it is necessary to consider the circumstances in which the crop was grown.

In 1893 there was a perfect seed-time for the turnip crop in Banffshire; but from the time the seed was put in till nearly two months thereafter there was continuous drought, and although the weather was genial, the absence of moisture greatly retarded the growth of the crop in its youth. When the weather broke an unusually wet autumn followed. These conditions are not favourable to the action of light manures, and hence the crop is only a moderate one—about 20 tons per acre. It must also be remembered that in most cases the experiment was tried in the worst fields of the farms—frequently on land that had borne two white crops in succession, or that was otherwise run out, and regarding whose future treatment some information was wanted.

The differences between the various plots are not so striking as one is accustomed to notice in many records of manurial experiments, but in this case none were expected. The manures, except in the case of plots 5 and 8, are put on at the same cost per acre, and are regarded as sufficient to raise a full crop.

Taking all these circumstances into account, the slight differences which do exist acquire enhanced significance, and we are able to deduce from the results the following conclusions.

Bone-meal is the slowest of the phosphates used, superphosphate is the most active, and is better than slag when applied at an equal cost per acre; but a mixture of superphosphate and slag has done better than either separately.

There is no advantage whatever in increasing the quantity of nitrate of soda over 1 cwt. per acre. The extra cwt. of nitrate of soda applied to plot 5 at the cost of 10s. per acre has simply been thrown away. Perhaps it would be more correct to say it has been washed away.

The constantly debated question as to whether nitrate of soda or sulphate of ammonia is the more appropriate soluble nitrogenous manure for turnips has received an answer here, but the answer is one which must be read in the light of the circumstances of the season. In Banffshire last season sulphate of ammonia has done better than nitrate of soda when applied in equivalent quantities. To prove that, we have only to compare plots 1 and 2 with the corresponding plots 6 and 7. It might have been the other way about if the character of the season

had been different. It is evident that the extreme drought prevented both these manures from coming into operation for a long time, and that when drought gave place to floods the more soluble nitrate was considerably washed out of the soil, and prevented from aiding the growth during the late part of the season. This experience should lead one to the conclusion that the best kind of soluble nitrogenous manure is neither sulphate of ammonia nor nitrate of soda, but a mixture of the two—the nitrate to act immediately, and the sulphate to come into operation later, and with less risk of loss. The constituent that has done most for the crop, despite the drought, is phosphoric acid, and in its case also we are led to the conclusion that a mixture of super and slag is better than either separately,—the superphosphate for more immediate, and the slag for less immediate use. The quantity of phosphatic mixture was very considerable —viz., 7½ cwt., costing about 16s.; but it raised the crop from 11 tons 7 cwt. to 19 tons 10 cwt. It is probable that a less quantity would have been more economical. When, in addition to the phosphate, 1 cwt. per acre of nitrate of soda, or an equivalent amount of sulphate of ammonia, was applied at a cost of about 10s. per acre, there was a further increase of about 2½ tons; and if we reckon a ton of turnips as worth not much more than 5s., in many cases the nitrate has done little more than repaid its cost. That the double dose of nitrate should have produced less than the single dose is not very remarkable. An overdose of nitrate frequently does more harm than good, and in this case it injured the crop on many of the farms, as it was frequently reported that there were far more diseased roots on plot 5 than on any other.

In the Central, Speyside, and Enzie districts the manures were applied also to land that had been dunged, and a comparison of the crops grown with and without dung conveys some important lessons.

A year of drought is one in which farmyard manure should be superior to every other, and it is seldom that a season will occur more favourable to the dung in comparison with light manures than 1893. Nevertheless, we see that dung alone on plot 9 has not done better than artificials on plots 4 and 7. From 15 to 30 loads of dung were applied, and the average would be about twenty loads per acre. The value of a load of dung would not be reckoned at less than 4s.; so that the cost of the dung, apart from the expense of cartage and spreading, would be about £4 per acre. We thus see that, so far as the turnip crop is concerned, the application of £4 worth of dung has not raised more turnips than 26s. worth of phosphates and nitrogen, and, as plot 8 informs us, only 1¼ ton more than a mixture of superphosphate and slag at a cost of 16s. per acre.

Of course it will be said that the dung is intended to last for a rotation, and the barley and grass will get the benefit of what the turnips have left. That is quite true, but it is only half a truth; the succeeding crops will get the benefit of only a certain amount of what the turnips have left. What fraction of the residue that will be depends on the power of the soil to retain the soluble constituents of dung, and whether the winter is wet or dry. It need not be doubted that there will be a great deal of loss; and it is quite evident that dung is a costly manure for turnips, and still more costly for cereals and grass if applied only to the turnip-break. In making that statement, I trust I shall not be regarded as undervaluing the importance of farmyard manure. I am well aware that it is the most valuable and important of all manures. Its value as a manure is not limited to supplying merely the manurial ingredients—phosphoric acid, nitrogenous matter, and potash which are contained in the fertilisers with which we are comparing it. It has other very important functions to perform in contributing to the fertility of the soil—functions which the fertilisers we are considering cannot accomplish. It not only improves the texture of the soil in a way that these light manures cannot, but it gives life to the soil, and is, as it were, the leaven of the land, and in the application of it we have to consider how we can best conserve it and maintain its vitality. A season more favourable to dung and less favourable to light manures than 1893 may not occur in a generation, and yet it is evident that we are not using farmyard manure to the best advantage. The returns made by the experimenters showed also that it was not the heaviest dunged land that showed dung to greatest advantage. A careful study of the returns impresses me with the belief that the majority of turnip crops are far more heavily dunged than they need be, and that there is much loss from over-dunging. The turnip-break is a convenient place to put dung on, and dung is a very useful manure for the turnip crop; but it seems evident that on the majority of farms too much dung is being put on the turnip-break. If the one-half were so applied, and the other half put on the cleaned land or on the second year's grass, there would be an important saving of dung, and I have every reason to believe that there would be no diminution in the turnip crop, but a considerable increase in the other crops of the rotation.

It is further seen from a comparison of the dunged and undunged plots that the addition of artificials to the dung last year has done very little good—one or other separately raised about 20 tons of turnips, but both together raised at most about 24 tons. Artificials and dung together did not pay, except, perhaps, in the case of plot 8, which got only phosphates at the

rate of 16s. an acre put on it. On that plot there was an average increase of 3 tons per acre; on some farms a good deal more, and on others a good deal less. The addition of nitrogenous manures at the rate of 10s., or even 20s., per acre did not increase the crop so much as 1 ton per acre.

The lesson taught in all these districts is that the common practice is to put on double the dung that is economical, and along with the dung to spend double the money that is necessary for obtaining a full crop. The increase of crop, if any, that has been got by applying a great excess of dung, or more than 16s. worth of phosphatic manure, has been got at a loss.

So much for the general lessons taught by the Banffshire experiments. It only remains to notice one or two things in connection with them which are of interest. It was noticed that an unusual number of turnips had double, triple, or multiple tops—a peculiarity that is frequently attributed to the quality of the seed sown; but it was found that this habit of growth was prevalent on many farms where the farmers were accustomed to grow their own seed from carefully selected bulbs, and that the seed of no particular seed merchant was more liable to it than that of another. It was evidently due to some interference of growth associated in some way with the character of the season. Whether mere drought could have caused it, or whether it might have been caused by damage from insects, which, owing to the warm dry season, were more abundant or more destructive than usual, remained matter of conjecture.

A still more remarkable and more disastrous accident occurred to the turnip crop in Banffshire, and also to the crop in the neighbouring counties, in the attack of a caterpillar which was found often in great numbers devouring the young leaves on the crown of the turnip. When my attention was first drawn to them by Mr John Davidson on the farm of Forgieside, Keith, they were above half an inch long, and it may be that much of the multiple-topping just referred to was caused by the mischief done by the caterpillar at an earlier stage of its growth. Samples of the grub sent to the Board of Agriculture were submitted to Mr Whitehead, who reported on it as follows: "The swedes are injured by root- and stalk-eating insects whose action in bulbs, roots, and leaves at their bases has set up unhealthy action, and caused decay and rottenness. The action would indicate work of the larvæ of flies such as *Anthomyia radicum* and *A. crassica;* but no larvæ of either of these were found, and only one larva of *A. tuberosa* was found, which has usually been associated with potatoes. In the bulbs, however, or, more correctly, in the roots, there were found larvæ of a 'rove' beetle, as also in the leaves at their bases, close to the crown of the bulb or root.

They were feeding in the holes or tunnels which they had made. I believe them to be larvæ of a beetle belonging to the *Staphylinidæ*, known as *Exztilus sculpturatus.* This bettle lives in dung and decaying substances, and its larva feeds upon various vegetables and juicy plants, from which it sucks the sap. From the quantities that were in the roots and in the leaves, I should say they are the main cause of the harm. It has been said that they feed only on decaying matter; but I saw many of them actively engaged in feeding on the fresh, sappy parts of the leaves, which were full of holes made by them. It is difficult to suggest any remedial measures. Lime and soot, in the proportion of one part of soot to three parts of lime, dusted upon the crowns of the swedes, might prove unpleasant to them; but it is obviously difficult to get at them, as they are in the fleshy stalk."

In the month of September the grub had matured, and the turnip crop, which in many places seemed ruined, recovered wonderfully, and were a fair crop in November.

Lastly, the old enemy "finger-and-toe" was very prevalent in many districts, and so seriously attacked a number of the experiments that the results have had to be withheld as quite unreliable. The plot which suffered most was plot 5, to which a double dose of nitrate had been applied; and plot 1, with bone-meal and nitrate, was also very severely affected. Plot 9, which got no manure, was worse than any, and in some cases the crop almost disappeared from it. The more vigorous plots —2, 3, 4, and 7—suffered least of all.

It is evident from the results of these and many former experiments of a similar kind, that anything which weakens the young turnip plant—such as poverty of soil, undue stimulation of growth by the excessive application of soluble nitrogenous manures, unfortunate tilth, or any kind of external injury—renders the plant liable to finger-and-toe, if the germs of that disease are resident in the soil. On the other hand, when the conditions are favourable for making a vigorous plant, the crop grows to perfection, even when the germs of the disease are known to be present in the soil.

The growing prevalence of this disease is now becoming a serious matter in many districts, and calls for investigation, so that some remedy may be found for it. The liming of land upon the lea, the widening of the rotation from a four or five to a six or seven shift, and the intervention of a potato crop between two turnip crops, have all been known to get rid of the pest, which lives upon the roots of cruciferous plants; but it is probable that some simpler cure may be found as the result of observation and experiment.

Experimenters.

Central District—

Mr John Davidson, Forgieside, Keith.
Mr James Garden, Westertown, Botriphnie, Keith.
Mr George Gray, Cantly, Grange.
Mr Alexander Humphrey, Lower Towie, Botriphnie, Keith.
Mr William Hutcheson, Anchip.
Mr J. Leith, Glengerrick Mains, Keith.
Mr John Macpherson, Mulben, Keith.
Mr T. W. Murray, Auchluncart.
Mr Andrew Wilson, Berrylegs, Grange, Keith.
Mr George Donald, Ladyhill, Keith, *Secretary.*

Spey, Avon, and Fiddichside—

Sir George Macpherson-Grant of Ballindalloch.
Mr J. R. Findlay of Aberlour.
Mr John Alcock, Balvenie, Dufftown.
Mr J. T. Cumming, Cardow, Knockando.
Mr John Grant, Hatton, Aberlour.
Mr Alexander Hutcheson, Belnagarrow, Craigellachie.
Tutors of Master James W. H. Grant, Wester Elchies, Aberlour.
Mr A. R. Stuart, Inverfiddich, *Secretary.*

Boyndie District—

The Countess-Dowager of Seafield, Cullen House.
(Mr Lewis Beaton, Home Farm.)
Mr James Durno, Mains of Glasshaugh, Portsoy.
Mr William Guthrie, Brunton, Cullen.
Mr Alexander Kitchen, Clune, Deskford.
Mr C. Y. Michie, Forester's Lodge, Cullen.
Mr George Milne, Dytoch, Portsoy.
Mr George M. Park, Manse of Deskford, Cullen.
Mr George Smith, Ordens, Boyndie, Banff.
Mr Robert Turner, Cairnton of Boyndie, Portsoy.
Mr George Bruce, Tochineal, *Secretary.*

Enzie District—

Mr John H. Bailey, Braes, Enzie.
Mr Alexander Bobertson, Auchenhalrig, Fochabers.
Mr Alexander Smith, Bogs, Enzie, *Secretary.*

Note.—This experiment is being repeated this year in Banffshire, in order that the results may be further verified, and in order to see what the effect may be of a different season with different climatic conditions.

TABLE I.—SUMMARY OF RESULTS OF EXPERIMENTS ON MANURING TURNIPS IN BANFFSHIRE, 1893.

Four Districts without Dung.

No. of plot	1		2		3		4		5		6		7		8		9	
Manures	Bone-meal and nitrate		Superphosphate and nitrate		Slag and nitrate		Mixed super. and slag and nitrate		Mixed super. and slag and double nitrate		Bone-meal and ammonia sulphate		Super. and ammonia sulphate		Mixed super. and slag		Nothing	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Central	16	13	19	18	17	19	20	5	19	8	17	18	19	9	18	0	7	8
Speyside	18	17	21	17	21	0	22	16	23	6	19	17	22	3	20	5	10	14
Boyndie	22	6	24	15	22	7	24	15	23	11	20	14	22	3	21	10	14	15
Enzie	13	5	15	10	16	0	17	18	18	8	16	18	19	8	18	4	12	10
25 experiments, average	17	15	20	7	19	4	22	3	21	3	18	17	21	16	19	10	11	7
Three Districts without Dung.																		
Central	16	13	19	18	17	19	20	5	19	8	17	18	19	9	18	0	7	8
Speyside	18	17	21	17	21	0	22	16	23	6	19	17	22	3	20	5	10	14
Enzie	13	5	15	10	16	0	17	18	18	8	16	18	19	8	18	4	12	10
15 experiments, average	16	5	18	19	18	3	20	6	20	7	18	14	20	7	18	16	10	4
The same along with Dung.																		
Central	18	15	21	18	20	17	20	10	21	17	20	1	21	16	19	16	19	2
Speyside	23	11	24	15	25	14	26	13	26	16	24	6	27	1	25	17	21	0
Enzie	20	10	23	7	22	2	22	7	23	5	21	18	23	15	23	7	20	3
15 experiments, average	20	19	23	7	22	17	23	3	23	19	22	2	24	4	23	0	20	1

TABLE II.—EXPERIMENT VIII. C. BANFFSHIRE, CENTRAL DISTRICT, 1893.

Without Dung.

No. of plot	1		2		3		4		5		6		7		8		9	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
1. Cantly, Grange	14	5	17	17	17	17	18	17	20	2	18	8	19	5	21	0	15	0
2. Lower Towie, Botriphnie	19	3	18	8	17	14	22	8	25	14	20	17	21	6	17	14	11	0
3. Glengerrack Mains, ,,	12	19	17	5	11	10	17	5	13	13	...		...		10	15	5	0
4. Westertown, ,,	15	1	15	15	16	0	15	8	16	0	12	0	13	8	15	5	4	0
5. Anchip	16	19	23	0	17	17	24	12	19	19	20	13	23	4	22	1	10	4
6. Mulben, Keith	20	7	21	18	20	16	22	4	22	0	18	1	18	10	18	17	6	11
7. Forgieside, ,,	16	10	19	15	17	15	19	7	18	0	16	17	19	10	18	7	6	10
8. Auchluncart	18	11	21	7	20	5	21	17	20	0	18	10	21	0	20	4	1	0
Average	16	13	19	8	17	9	20	5	19	8	17	18	19	9	18	0	7	8

With Dung.

No. of plot	1		2		3		4		5		6		7		8		9	
9. Cantly, Grange	17	17	21	5	22	11	17	17	20	5	18	5	21	2	18	8	20	5
10. Lower Towie, Botriphnie	20	11	23	11	23	3	27	0	25	6	25	11	25	17	22	11	23	11
11. Glengerrack Mains, ,,	15	16	23	14	20	17	20	3	25	3	21	12	22	6	23	0	15	2
12. Westertown, ,,	18	14	19	9	18	0	19	2	20	7	18	0	19	13	17	15	...	
13. Forgieside, Keith	22	0	22	2	20	10	19	12	20	17	20	5	22	15	20	17	20	10
14. Berryleys, Grange	17	14	21	8	20	5	19	6	19	6	16	14	19	5	16	8	14	3
Average	18	15	21	18	20	17	20	10	21	17	20	1	21	16	19	16	19	2

NOTES.

1 and 9. Heavy loam on clay; soil hard and dry; braird uneven; crop blanky.
2 ,, 10. Black strong loam on clay. Plot 5, dunged, was inferior also in quality.
7 ,, 13. Strong dark loam.
3 ,, 11. Loam with clay. Plots 6 and 7 abnormally deficient.
4. Light loam. Plot 1 brairded badly. Plot 7 looked best.
5. Gravelly loam. Land grows poorer from 1 to 9.
6 and 12. Light loam. Whole crop severely attacked by caterpillar.
8. Poor, thin, somewhat clayey.
14. Severely attacked by caterpillar. The undunged plots destroyed thereby.

Anchip and Mulben were swedes; the others yellow.

TABLE III.—EXPERIMENT VIII. C. BANFFSHIRE, BOYNDIE DISTRICT, 1893.

Without Dung.

No. of plot	1		2		3		4		5		6		7		8		9	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
1. Deskford Manse	17	2	17	2	19	0	19	4	21	16	21	14	19	9	20	15	11	10
2. Dytoch	26	5	28	17	26	8	27	0	26	15	19	0	23	7	18	0	12	0
3. Mains of Glasshaugh	16	(fly)	21	3	20	14	21	8	20	5	18	0	19	1	23	5	14	11
4. Clune, Deskford	25	10	30	4	21	12	27	17	27	0	26	3	28	14	24	19	21	8
5. Forester's Lodge, Cullen	17	0	18	0	14	10	17	10	16	10	15	10	14	0	15	0	12	10
6. Cullen Home Farm	22	14	25	15	24	4	27	17	27	19	25	16	26	3	29	9	19	17
7. Cairnton of Boyndie	25	14	26	0	25	11	28	17	25	9	22	17	23	11	22	11	17	2
8. Ordens, Boyndie	21	5	24	9	25	7	26	1	25	10	22	17	24	5	25	10	9	0
Average	21	9	22	15	22	4	24	9	23	18	21	9	22	6	22	8	14	15
Average, omitting 1 and 8	22	6	24	15	22	7	24	15	23	11	20	14	22	3	21	10	...	
With Dung.																		
9. Cullen Home Farm	28	10	35	5	36	0	31	17	34	2	34	13	38	0	30	12	29	12

NOTES.

1. Stiff clay; subsoil very hard, wet. Soil seems improving from 1 to 9.
2. Clay.
3. Loamy clay. No. 1 attacked by fly more severely than the others. No. 3 improved most in October.
4. Heavy loam. Nos. 6, 7, and 8 had more diseased roots than the others.
5. Hazel loam. An additional plot with potash manure should show potash was wanted.
6. Loam. Soil seems improving from 1 to 9.
7. Sandy loam. Nos. 5, 6, and 7 most affected with finger-and-toe—No. 7 the worst.
8. Light black soil.
9. Moss. Land rich in nitrogen. Phosphate and potash needed.

TABLE IV.—EXPERIMENT VIII. C. BANFFSHIRE, ENZIE DISTRICT, 1893.

No. of plot	1		2		3		4		5		6		7		8		9	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Without Dung.																		
1. Braes, Enzie	16	8	19	1	18	2	19	6	21	19	17	18	21	15	20	5	...	
2. Bogs, ,,	8	7	10	0	12	1	14	3	8	15	12	7	15	12	12	17	8	2
3. Auchenhalrig	15	0	17	10	17	16	20	6	24	9	20	10	20	18	21	11	17	0
Average	13	5	15	10	16	0	17	18	18	8	16	18	19	8	18	4	12	10
With Dung																		
4. Braes, Enzie	15	18	20	9	17	14	18	17	21	2	18	17	21	15	21	10	...	
5. Bogs, ,,	23	11	25	5	24	8	25	2	25	0	24	2	25	6	25	18	20	13
6. Auchenhalrig	19	7	24	8	24	4	23	2	23	13	20	17	24	4	20	13	19	14
Average	20	10	23	7	22	2	22	7	23	5	21	18	23	15	23	7	20	3

NOTES.

1. Strong heavy loam. Finger-and-toe prevalent, especially in Plot 1.
2. Sandy clay. Finger-and-toe prevalent. Mildew appeared in August over whole field.
3. Sandy loam. Finger-and toe prevalent.
4. Strong heavy loam. Finger-and-toe prevalent.
5. Heavy loam. Finger-and-toe prevalent. Also mildewed.
6. Sandy loam. Finger-and-toe prevalent.

TABLE V.—EXPERIMENT VIII. C. BANFFSHIRE, SPEYSIDE, 1893.

Without Dung.

No. of plot . . .	1		2		3		4		5		6		7		8		9	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
1. Inverfiddich . .	12	2	18	7	18	1	16	5	18	13	17	2	18	0	13	15	3	17
2. Belnagarrow .	22	0	26	7	24	0	30	9	31	0	23	0	26	0	25	0	3	6
3. Aberlour . .	22	0	22	3	21	12	21	17	22	0	22	0	22	2	21	19	18	16
4. Ballindalloch .	13	16	18	13	13	18	16	16	15	19	15	12	20	7	16	12	12	2
5. Hatton, Aberlour .	22	7	22	15	24	4	25	18	27	1	21	17	23	10	24	13	17	10
6. Cardow, Knockando	20	15	22	15	24	2	25	9	25	1	19	13	23	1	19	13	8	15
Average . .	18	17	21	17	21	0	22	16	23	6	19	17	22	3	20	5	10	14

With Dung.

No. of plot	1		2		3		4		5		6		7		8		9	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
7. Inverfiddich . .	16	10	18	7	19	2	21	0	21	8	18	17	20	15	16	7	16	6
8. Belnagarrow . .	23	0	27	4	27	0	28	0	30	4	22	0	30	7	30	0	18	0
9. Aberlour . .	30	1	30	6	30	0	30	2	30	8	30	1	30	6	30	1	28	2
10. Ballindalloch .	19	5	18	6	20	17	21	12	20	14	17	10	19	5	21	13	15	5
11. Hatton, Aberlour .	28	10	27	19	30	10	29	2	29	2	28	16	30	16	29	13	22	3
12. Cardow, Knockando	24	0	26	6	26	18	30	0	29	0	28	11	30	18	27	9	26	2
Average . .	23	11	24	15	25	14	26	13	26	16	24	6	27	1	25	17	21	0

NOTES.

1 and 7. Heavy clay loam. Wet. After three white crops in succession. Much damaged by caterpillar.

2 ,, 8. Rich loam with clay. Dry. Thunderstorm three days after sowing did much damage.

3 ,, 9. Deep free loam in high condition.

4. Loam on gravel. No disease or accident.

5 and 11. Medium loam. After two crops oats.

6 ,, 12. Light loam on reddish subsoil. No rain for two months after sowing.

10. Finger-and-toe prevalent. Worst in Plot 6; least in Plot 8.

REVIEW OF THE WORK DONE BY LOCAL ANALYTICAL ASSOCIATIONS UNDER THE SOCIETY'S REGULATIONS.

Now that the Fertilisers and Feeding Stuffs Act, 1893, has come into force, it has become necessary for the Society to suspend the operations under its scheme for regulating the conduct of local analytical associations, at least to the extent of withholding the money grant in aid of the cost of analyses, which formed, if not the essence, at least an essential feature of its scheme. Each county is now expected to contribute money out of the rates for the purpose of enabling farmers to obtain analyses of the manures and feeding stuffs purchased by them at reduced fees, and that being so, it is evident that the continuance of the Society's subsidy to associations for that purpose might be regarded by its members as money spent for the relief of the ratepayers in general and not for farmers in particular. It would be premature to discuss the merits or demerits of the Act until it has had a trial, and before the regulations of the Board of Agriculture for carrying out the provisions of the Act have been issued in a complete form; but it will be useful to shortly review the work that has been accomplished by the local analytical associations of Scotland since they came under the guidance and protection of the Society, and consider how they are affected by recent legislation.

A local analytical association is simply a voluntary association of a number of farmers in a district for the purpose, primarily, of protecting themselves against loss from the purchase of manures and feeding stuffs of a spurious kind or of inferior quality; and secondarily, for the purpose of obtaining as much information as possible about the nature and value of these substances, the best way of buying them, and the most economical way of applying them. For this purpose the members subscribe annually a small amount per head, or a small sum per hundred acres of arable land on their holdings, to provide a fund out of which to pay the cost of a certain number of analyses, and to meet the expenses incurred in publishing the results of these and distributing them privately among the members. By the publication of the chemists' reports the members are informed of the character of the manures and feeding-stuffs supplied by the merchants who cater for the district, and they are made aware of any instances in which sellers have supplied inferior or spurious substances, or in which they have supplied substances at prices above their proper value. In this way members get to know what merchants to buy from and which to avoid. The advantages derived from this system were so manifest that associa-

tions were formed in most of the important agricultural districts of Scotland twenty years ago.

In 1881 the good work they were doing was brought under the notice of the Society, and it was resolved to assist them by means of a money grant of 5s. for each full analysis and half that sum for each partial analysis, upon condition that they would conduct their operations in such a way as to secure accuracy and safeguard the interests of buyers and sellers alike. Regulations were drawn up for their guidance, and thirteen associations took advantage of the Society's offer the first year. The Society was willing to spend £250 per annum in this way, but it was found that only one-fifth of this sum was necessary. Experience showed that many of the associations had been conducting their operations in a somewhat loose manner, and that there was great need of a central controlling power to secure uniformity of action and perfect fairness to sellers as well as buyers. The requirements of the Chemical Committee became year by year more stringent, and it was resolved in 1884 to double the amount of the grant. The subjoined statement shows the number of associations that applied annually for the Society's assistance, the number of analyses for which grants were given, and the amount of the grant in each year.

Analyses through Associations, 1881-93.

	No. of Associations.	No. of Analyses.	Amount of Grant.
1881 . .	13	221	£54 10 0
1882 . .	14	202	49 0 0
1883 . .	10	143	33 10 0
1884 . .	15	255	122 15 0
1885 . .	16	255	112 5 0
1886 . .	15	226	96 0 0
1887 . .	14	216	92 5 0
1888 . .	14	187	77 15 0
1889 . .	18	257	107 15 0
1890 . .	20	208	87 5 0
1891 . .	19	265	109 10 0
1892 . .	15	182	72 15 0
1893 . .	19	265	112 15 0

The figures show considerable fluctuations, but these are to some extent accounted for by the fact that in 1888 and 1892 one or more associations were too late in sending in their reports for the year, and as a consequence their reports and the amount of grant claimed by them were held over till the following years. It may be stated roughly that during the last ten years, since the doubling of the amount of the grant, the number

of analyses done for associations in conformity with the Society's regulations, and for which a grant was given, averaged 230 annually, and the amount of the grant for them was just about £100 annually.

Some idea of the amount of good done by that comparatively small annual expenditure may be attained by comparing the state of matters when the Society's scheme began and that which has existed during the last few years.

In 1881, when the first reports came in from the associations, it was found that more than 6 per cent of the manures purchased were bought blindfold—that is to say, with no guarantee. Of those guaranteed, the guarantees in a great many cases were useless, and many were worse than useless, for they were misleading and fallacious. Of those whose guarantees were neither misleading nor fallacious, nearly the half were found to be inferior to their guarantees. One-fifth of the manures purchased by members of the associations were special compounds usually sold under fancy names and bought at fancy prices. In some districts it was not uncommon to find manures sold at half as much again as they were worth. On the other hand, manure merchants who were carrying on a legitimate trade, and who were content with reasonable profits, were placed at considerable disadvantage, and had often good reason to complain of the scant measure of justice meted out to them by the associations. They had no control whatever over the methods used for sampling their deliveries, and the methods of sampling adopted by some associations were not trustworthy, and it frequently happened that the sampling was left to the purchaser alone. In those days it was the custom to ask the chemist of the association to put a commercial value on the manures he analysed, and he was permitted to value them in any way he pleased. The result was that the valuations put upon the same manure by different chemists were often absurdly at variance. The seller was not allowed to have any voice in determining the method of valuation, and the chemist was put in a false position. There were other troubles, that would take too long to describe, which were an inconvenience to buyers and sellers alike, and chief among these were the diverse methods used by chemists in stating the results of their analyses, so that different analyses of the same manures were not comparable, and no one who was not possessed of some chemical knowledge could make use of an analysis when he got it.

To clear away all these abuses and anomalies was the work which the Chemical Committee set before it when it took in hand the control and regulation of the associations, and it took a good many years to accomplish the work, for it had to be done gradually, and in such a manner as to secure the confi-

dence and approval of all the interests concerned. The whole scheme of regulations and information, described and published annually in Appendix B of the 'Transactions,' has received very little alteration during the last three years. It provides a uniform method of procedure in which the interests of both buyer and seller are safeguarded, and uniform methods of expressing guarantees, of stating analyses, and of valuing manures, whereby all the advantages of an association may be enjoyed without any of the inconveniences, misunderstandings, and difficulties which originally stood in the way of their usefulness.

The beneficial change which has been wrought under the Society's watchful care is shown by the results of the scrutiny of the schedules sent in by the associations to the Chemical Committee last season. Out of the 265 samples analysed for the associations last year, there were five cases of deficiency, but three of these admitted of satisfactory explanation, and one had to be abandoned by the Committee on account of an irregularity in carrying out the Society's regulations; so that the only case of deficiency that calls for notice is a consignment of linseed-cake sold by Mr Robert Morison, Arbroath, to a member of the Arbroath Analytical Association, in which the albuminoids were guaranteed at 28 per cent, and found to be only 24½ per cent. It was also found to be an impure cake. But for this unfortunate case there would this year have been no deficiencies to record. During the first year of the Society's operations one-fifth of all the purchases were deficient from their guarantees, and had the same strict method of scrutiny been applied to them that has been applied to the returns of last year, there would have been at least thirty cases of deficiency to record. During the first years the great majority of purchases were made at prices above, and in many cases far above, their values; but last year we find that in the great majority of instances the manures were bought at prices somewhat below their value, as estimated by the use of a set of units carefully adjusted to suit market prices by the Chemical Committee, after consultation with manure merchants of the best reputation. Illusory guarantees, misleading names, fraudulent manures, and even exorbitant prices, are of rare occurrence in districts where associations are at work. Members of associations know what they are buying and how to buy advantageously, and manure merchants are rivalling each other in their efforts to produce manures not only true to name, but better than their guarantees, and at the lowest remunerative prices.

Now that the Government, late in the day, have passed an Act to remedy the abuses that used to prevail in Scotland, and that still prevail in other parts of the country, there is reason to fear that some of the associations, deprived as they are of the

Society's grant, may consider it unnecessary to continue their operations.

If the scope of the Act covered all that was done by the associations, there would be no advantage in continuing their activity, but that is far from being the case. The associations accomplished their object by a system of education and mutual improvement, whereby buyers were taught to understand the nature of the substances they were buying, and the best way to buy them. The provisions of the Act may be excellent so far as they go, but they cannot accomplish, nor are they intended to accomplish, all the work done by the associations. The effect of the Act is to accomplish for members of associations much that was done for them by the Society; and there is this to be said in its favour, that its provisions are for the benefit of farmers in all parts of the country, whether there be analytical associations established there or not, and we shall see after some time whether it will be taken advantage of.

One of the great advantages enjoyed by members of associations under the Society's scheme has been that the Society has taken the initiative in bringing to light and investigating cases of deficiency, and has taken the entire responsibility of publishing all cases coming under its cognisance where it seemed to the Committee that the members were being unfairly treated. The members whose interests were thus being looked after had no voice in the matter, and no pressure brought to bear upon them could avail to prevent the Society from publishing the full details of any transaction which the Committee considered deserving of its censure. The fact that in no case has the Society required to defend its action in a court of law, shows how careful the Committee have been to avoid doing anything which could be considered unjust to the sellers whose names they published; but it is not to be supposed that if the Society had not been known to be able and ready to defend its procedure, that actions would not have been raised. Manure-vendors have frequently threatened to raise an action, but they have been wise enough not to carry their threats into execution.

The Fertilisers and Feeding Stuffs Act leaves it to the buyer himself to obtain redress in cases where the materials supplied may be found deficient; but in section 7, sub-section 1, it provides that a prosecution for an offence under this Act may be instituted also by the council of a county, a borough, or *by any body or association authorised in that behalf by the Board of Agriculture.* This is an important provision, but it is merely permissive, and it remains to be seen whether county councils will seek that authority and prosecute offenders or not. Should County Councils refuse to take upon themselves that duty, then the analytical associations would be performing a very im-

portant service if they obtained the authority of the Board of Agriculture to institute a prosecution, if a clear case for such action should arise.

Whether they take upon themselves that additional responsibility or not, it is evident that there is nothing in the Act to prevent their carrying on their work under the regulations of the Board of Agriculture in the same way as they have hitherto done under those of the Highland and Agricultural Society. They have still important educative and protective functions to perform, and if there are defects in the Act that require to be remedied, or if there are directions in which its operations should be extended, it is to the associations that the Society will look for aid in discovering these, and in pointing out the way in which any required changes may be most beneficially effected. The Society, on its part, has already shown its desire to continue to support the associations by renewing its annual vote to assist them in whatever way experience shall show it to be desirable.

TRIAL OF BINDERS.

An exhibition of combined reapers and binders at work took place under the auspices of the Society at Niddrie Mains, near Edinburgh, on Wednesday the 16th August 1893, on fields kindly given for the occasion by Mr T. M. Skirving.

The weather was favourable, and nearly 200 farmers witnessed the trial.

Entries.

The following eleven machines were tried:—

J. Bisset & Sons, Blairgowrie—Steel frame binder, with open back and endless aprons.
R. Dodds, Chirnside—Open end binder, made by the Johnson Harvester Co., Batavia, New York.
P. & R. Fleming & Co., 16 Graham Square, Glasgow—Rear discharge "Bindlochine" binder, and an all steel open end binder, both made by the M'Cormick Harvesting Machine Co.
R. Hornsby & Sons, Limited, Grantham—No. 12A light steel open back binder.
J. & H. Keyworth, 35 Tarleton Street, Liverpool—"Adriance" rear discharge binder, made by Adriance, Platt, & Co., New York.
A. Newlands & Son, Linlithgow—Light steel open back binder, made by G. Kearsley, Ripon.
Samuelson & Co., Limited, Banbury—Steel frame open end binder with low elevators.
John Wallace & Sons, Graham Square, Glasgow—The Mercer steel binder with no canvas, made by Mercer Brothers, Alliston, Canada; and the Massey-Harris open end binder, made by the Massey-Harris Co., Limited, 54 Bunhill Row, London.
Walter A. Wood, M. & R. M. Co., 36 Worship Street, London, E.C.—Single apron binder.

Committee and Attending Members.

The following gentlemen were appointed to act as a Committee, to carefully watch the working of the various machines, and prepare a report of the results—viz.: Messrs Jonathan Middleton, Clay of Allan, Ross-shire; G. R. Glendinning, Hatton Mains, Wilkieston; A. S. Logan, Ferney Castle, Reston; J. T. S. Paterson, 55 Grange Loan, Edinburgh; and James D. Park, the Society's engineer.

The following gentlemen also assisted in carrying out the trial—viz.: Messrs Walter Elliot, Hollybush, Galashiels; R. Shirra Gibb, Boon, Lauder; D. Fisher, Jellyholm, Alloa; John Dobbie, Campend, Dalkeith; R. B. Macdonald, Granton Mains, Edinburgh; and Thomas Morton, Redheugh, Gorebridge.

Report of the Committee.

The report of the Committee is as follows:—

We, the undersigned, have pleasure in reporting that we carefully watched the working of the eleven binders that came forward. They were, in the first place, tried in a field of oats, which was cut into plots of one acre each. Lots were drawn by the competitors for the different plots, and care was taken to make the trial as even as possible to all. The oat crop was very rank, and badly laid and twisted. The test was therefore an exceedingly severe one. Indeed, much of the crop was so greatly laid and twisted that it seemed hardly likely that either the binder or the reaper could possibly make passable work in it. In these circumstances it is peculiarly gratifying to be able to say that, upon the whole, the work of cutting and binding was done in a satisfactory manner—better cut, most probably, than it would have been by the ordinary reaper. Very little fault could be found with either the cutting or binding. Most of the machines had difficulty in separating the one sheaf from the other on account of the rank tangled condition of the crop, yet even in this respect the majority of the machines did surprisingly good work. The crop could be cut only in one direction, and in most cases the work was slowly done.

As to the individual display of the binders tried, we think it undesirable to say much. With the work all round of such high excellence, it would indeed be unsafe to attempt to particularise to a pronounced extent, or to draw definite comparisons.

Bisset's Binder.—This binder seemed easy on the horses, doing its work speedily and well. It left an unusually low, even stubble, and divided the sheaves cleanly. There were several loose sheaves in the plot, obviously the fault of the twine, which, owing to an accident, was not of the kind intended to be used.

Johnson Harvester.—This machine did its work fairly well, the crop being heavy and very badly twisted.

"*Bindlochine*" *Binder.*—The horses in this machine were much too light, and on this account the trial could not be regarded as satisfactory. In the rank oat crop the work was defective, but in the lighter crop of barley it was almost all that could have been desired.

M'Cormick's Side Delivery.—In a very heavy crop, much twisted, this binder worked moderately well. It choked several times, threw off a few loose sheaves, and was rather heavy on the horses.

Hornsby's Binder.—The quality of the work done by this binder was surprisingly good, considering the trying character of the crop. The draught was somewhat heavy, but the stubble was low and even, and except where the crop was very badly twisted, the sheaves were well separated. There were a few stoppages from choking, and a very few loose sheaves.

"Adriance" Binder.—This light binder did remarkably fine work, its plot being scarcely so much twisted as some of the others. It left an even stubble of average length, made very few mistakes in binding, and was comparatively easy on the horses.

Kearsley Binder.—This binder having been late in reaching the field, cut only about half its plot. This it did in a very satisfactory manner, alike as to speed and the quality of the work.

Samuelson's Binder.—In one of the easiest plots this binder made good speed, cutting cleanly, and binding well. Neater sheaves might have been looked for here.

Mercer Binder.—The cutting and binding were very well done on this plot, but the dividing might have been better. There was not a little shedding of grain.

Massey-Harris Binder.—In a very bad plot this binder did remarkable fine work, cutting low, separating well, and binding admirably. There were no loose sheaves, and almost no delay.

Wood's Binder.—This binder had one of the worst plots in the field, yet the quality of the work was of a very high order. It made surprising speed considering the character of the crop. The cutting was low, even, and clean, binding excellent, and the separating exceptionally well done.

As each machine finished its acre of oats it was taken to a plot retained for the purpose of testing the draught. Here two rounds were made, and the draught, width of cut, and height of stubble were taken during the second round.

The machines were then tried in an adjacent field of barley. The crop of barley was not rank, but it was much laid and twisted. The quality of the work done here was throughout of the most satisfactory character—so nearly perfect, indeed, that the most fastidious farmer could find little fault with it. This great success with the barley is all the more noteworthy and gratifying that, when examined by a large committee of experienced farmers a fortnight before the trial, the crop on this field was so much laid and twisted that it was thought unlikely that any competitor would attempt to cut it either w th a reaper or binder.

The following table shows the time taken to cut the acre of oats, the approximate draught gauged by the ordinary dynamometer, the width of cut where draught was taken, and

the height of stubble when the draught was taken, for each machine:—

Machine.	Time to cut 1 acre of oats.		Approximate average draught.	Average width of cut.		Height of stubble.
	hours.	min.	cwt.	ft.	in.	inches.
Bisset . . . , .	1	32	5¼	3	11	2¼
Johnson	3	2	...	4	5	3
M'Cormick "Bindlochine" .	...	...	5¼	4	2⅓	3¼
" open end . .	2	39	6¼	3	2⅝	3½
Hornsby	2	5	5¾	3	11½	3¾
"Adriance". . . .	1	46	4¾	4	9½	3½
Kearsley (½ acre) . . .	...	...	5¾	4	4	3¾
Samuelson	1	37	5½	4	0⅜	3⅝
Mercer.	2	38	5½	3	10	3⅝
Massey-Harris . . .	1	49	5¼	3	11⅜	3¾
Wood	1	54	5½	4	4⅛	4¼

The plot on which the draught was tested was a trifle heavier at one side than at the other. The machines tried on the heavier side were the Hornsby, Massey-Harris, Wood, Bisset, M'Cormick (open end), and the Mercer.

The time is omitted in the case of the "Bindlochine" Binder, on account of delays by incapable horses; and in the case of the Kearsley Binder because of its late arrival. The draught of the Johnson Harvester is omitted on account of an accident to the knife.

JONATHAN MIDDLETON. J. T. S. PATERSON.
G. R. GLENDINNING. JAMES D. PARK.
A. S. LOGAN.

GENERAL SHOW AT EDINBURGH, 1893.

THE Sixty-sixth Show of the Society, the twelfth in the Edinburgh district, took place in the Dean Park, Edinburgh, on 25th July 1893, and three following days.

A fairly convenient Showyard, extending to about 25 acres, was lined off on the site of the Centenary Show of the Society in 1884. Although smaller in extent than that great exhibition, the Show of 1893 was in no respect less interesting or inferior in character. In a financial sense it was even more

successful, the net profit to the Society exceeding that from the Centenary Show by over £400.

There was but one disappointment connected with the Show. His Royal Highness the Duke of York was graciously pleased to accept the Presidency of the Society for the year, with the view of attending the Show. When it was made known that the arrangements in connection with the marriage of his Royal Highness and the Princess Victoria Mary of Teck would prevent the Duke of York from visiting the Show, much regret was expressed throughout the country. By no one was this disappointment more sincerely regretted than by his Royal Highness himself, who has evinced his interest in the welfare of the National Agricultural Society of Scotland by again accepting the Presidency of the Society, with the intention of attending its annual Show at Aberdeen next July. In view of the unavoidable absence of his Royal Highness, the brilliant success of the Edinburgh Show of last year is all the more noteworthy and encouraging.

On the opening day, from 8 A.M. till just before the judging began at ten o'clock, rain fell in torrents. Thereafter, with the exception of one or two slight showers towards the end of the meeting, the weather was delightfully fine.

The figures in the table a little further on show that the attendance of the public was very large. It was especially so on the Thursday, when, with holders of admission tickets of one kind or other, there were probably over 40,000 people in the Showyard. Comparatively speaking, the attendance on the Friday was somewhat disappointing—the result, most probably, of the introduction of two days of admission at one shilling.

The display of live stock has seldom been equalled in Scotland. Indeed it may be said safely enough that, with the single exception of the Centenary Show in 1884, the Show of 1893 will rank as the largest and best up to this date in the history of the Society. In the implement section it excelled even the Centenary Show.

Great interest was manifested in the contests for the Champion Cups offered by His Royal Highness the Duke of York. It will be seen from the prize-list that the contests were very close, especially in the sections for cattle and sheep.

Statistics.

The number of entries in the various sections is shown in the following tables:—

CATTLE.

	Bulls.	Cows.	Heifers.	Oxen.	Total.
Shorthorn	49	11	33	...	93
Aberdeen-Angus	29	19	36	...	84
Galloway	10	6	21	...	37
Highland	34	8	12	...	54
Ayrshire	17	26	21	...	64
Jersey	9	15	20	...	44
Extra	1	1	1	1	4
	149	86	144	1	380

HORSES.

	Stallions.	Entire Colts.	Mares.	Fillies.	Geldings.	Total.
For agricultural purposes	17	56	18	60	...	151
Hunters and roadsters	...	...	21	2	31	54
Yearlings, the produce of the Queen's premium stallions	...	1	...	11	1	13
Hackneys	6	15	31	16	7	75
Ponies	5	...	20	...	4	29
Shetland ponies	11	...	7	...	2	20
Extra horses	3	...	3	...	1	7
	42	72	100	89	46	349

SHEEP.

	Tups.	Ewes.	Gimmers.	Lambs.	Wethers.	Total.
Blackfaced	62	5	7	5	...	79
Cheviot	40	4	4	...	...	48
Border Leicester	34	4	9	...	...	47
Shropshire	24	6	10	8	...	48
Oxford Down	8	4	5	...	...	17
Half Bred	17	5	11	...	...	33
Extra sections	...	...	...	...	18	18
Extra sheep	2	1	...	...	1	4
	187	29	46	13	19	294

SWINE.

	Boars.	Sows.	Pigs.	Total.
Large white breed	4	4	4	12
White breed, other than large . .	2	3	3	8
Berkshire breed	4	5	2	11
	10	12	9	31

	Entries.
POULTRY	360
DAIRY PRODUCE—	
Butter	57
Cheese	31
IMPLEMENTS (197 stands)	2268

The following table gives a comparative view of the display of cattle, horses, sheep, swine, poultry, dairy produce, and implements, of the value of the premiums offered, and of the receipts, at the entrance gates, grand stands, and for catalogues at the Shows which have been held at Edinburgh:—

Year.	Cattle.	Horses.	Sheep.	Swine.	Poultry.	Dairy Produce.	Implements.	Premiums.	Receipts.
1822	58	...	8	2	...	...	...	£78	£51
1823	44	...	77	12	...	...	...	110	75
1824	62	...	89	5	...	...	30	105	59
1825	42	...	43	7	...	...	20	110	80
1827	44	...	158	6	...	...	50	224	83
1842	295	179	487	53	...	38	200	1200	1373
1848	351	142	760	58	128	165	310	1153	1398
1859	332	188	583	80	327	54	980	1500	2343
1869	310	212	764	42	717	...	1900	1600	4078
1877	339	342	596	38	302	...	2292	2714	6734
1884	580	453	1180	49	253	104	2282	4343	6548
1893	349	380	500	49	360	88	2268	2600	4917

Cattle.

It was decided in 1893 to abandon the long-continued practice of obtaining and printing reports from the Judges upon the stock judged by them. The notes here will therefore be confined to a very general view of the different sections of the Show, expressed in as few words as possible.

It will be noticed from the above table that all the breeds of cattle kept in Scotland to any appreciable extent were fairly well represented in numbers.

Shorthorns were decidedly better than the average of the past

few years. Around the judging-ring on the opening day of the Show were not a few well-known shorthorn authorities, who had been present at the Royal English Show at Chester in the preceding month. Amongst these authorities it was freely remarked that in several of the classes the display in the Scotch compared favourably with that in the English showyard. The majority of the winning animals exhibited good shapes, plenty of substance, and no lack either of quality or character. It is noteworthy that the best Shorthorn bull in the Show was a Scotch-bred animal, which is now located in England, and which, in 1892, changed owners in the sale-ring at the sensational price of one thousand guineas.

Of the Aberdeen-Angus breed, nothing else than a first-class turn-out is now expected. The yearling bulls, as a lot, have often been better; but in the other classes the standard of merit was very high. The older classes of this breed formed one of the finest features in the Show.

Galloway cattle made a strong appearance in general character. The male classes were not large, but they included some very fine animals. The female classes were specially good, the heifers in particular making a capital display.

West Highland cattle are always an attractive feature in the Highland Show. So far from their home, they made a very creditable muster on this occasion. All over, the classes were strong in merit.

The Ayrshire, the great dairy breed of the south-west of Scotland, never fails to exhibit a very high average standard of merit at this Show. The entries may at times be few, but there is never any lack of merit in the winners. The breed was unusually well represented at Edinburgh, all the classes being creditably filled, and including animals that displayed the highest types of the modern Ayrshire.

For the first time—thanks to the enterprise of Major Wardlaw Ramsay—special classes were provided for Jersey cattle. The number of entries in these was wonderfully large, and the majority of the animals was of a high character.

Horses.

Clydesdale horses made a very fine display. It will be noticed that the classes were well filled, and in regard to merit the breed has rarely done itself greater credit. Alike in the male and female classes, the best characteristics of the typical Clydesdale were well represented. Unusually exciting contests took place in most of the classes, so close were the animals in general merit.

Seventeen entries made an exceptionally strong class of aged

Clydesdale stallions; and the three- and two-year-old classes were just about as large and as creditably filled. Amongst yearling colts there were some animals of great promise, the "Derby" prizes giving additional interest to the display of Clydesdale yearlings.

The classes of Clydesdale mares were very strong, containing as they did some noted prize-winners. The younger female classes were very large, there having been no fewer than twenty-two two-year-old and twenty-nine yearling Clydesdale fillies; and, like the class of three-year-old fillies, these classes displayed a very high standard of merit.

The show of horses for road and field was above the average, both as to numbers and quality; while the growing popularity of the hackney in Scotland was demonstrated by the finest display of hackney horses ever seen north of the Border. The pony and Shetland pony classes were also well filled.

The driving contests excited much interest. Jumping competitions were arranged on a much more extensive scale than hitherto, and the result was a brilliant success. The entries were fairly numerous, and the jumping was of a high order.

Sheep, Swine, &c.

The collection of sheep left nothing to be desired in regard to merit, and in most of the classes there was a large entry. Blackfaced sheep, as might be expected with so handsome a list of prizes, made an unusually strong display both as to numbers and character. The Cheviot, Border-Leicester, Shropshire, and Oxford-Down breeds were also creditably represented, while there were likewise strong classes of half-bred and fat sheep.

Swine, as usual, were few in number, but they were of an exceptionally high character. There was an excellent show of poultry and a capital collection of dairy produce.

In the section for Highland Industries there was a fairly good collection, but the quantity of goods sold was not so large as was expected.

The Working Dairy, conducted by the Dairy Supply Company, Limited, was a prominent centre of attraction in the Showyard. Mrs Lord's lectures and demonstrations on cream-separating and butter-making were listened to and watched with evident interest by large crowds of people.

The "Block-Test."

A "Block-Test" was conducted on each of the second and third days of the Show. Two animals—a bullock and a heifer—were used for the test each day. The animals were

shown alive during the day, and farmers were invited to examine them and estimate their dead-weight. For this purpose cards were provided for which a fee of one shilling was paid by each farmer. Prizes of £3, £2, and £1, were offered each day for the nearest estimates.

On Wednesday 106, and on Thursday 110 competitors handed in estimates.

The results are shown as follows:—

PRIZE-WINNERS.	No. of Animal.	Fasted live-weight.	Per cent of dead- to live-weight.	Actual dead-weight.	Estimate of Dead-weight.	Error.
Wednesday.		st. lb.		st. lb.	st. lb.	lb.
1. Jas. Paterson, Burnbank, Blair-drummond	1	69 12	56.33	39 5	39 4	1
	2	68 10	58.21	40 0	40 0	
2. John Edmond, Galamuir, Bannockburn	1	69 12	56.33	39 5	39 3	9
	2	68 10	58.21	40 0	39 7	
3. W. Duncan, Willtown, Coupar-Angus	1	69 12	56.33	39 5	39 12	17
	2	68 10	58.21	40 0	40 10	
Thursday.						
1. W. Fettes, Corskie, Garmouth .	3	89 13	57.66	51 12	52 0	17
	4	81 10	57.60	47 1	46 0	
2. Joseph Bowman, Lynehow, Carlisle	3	89 13	57.66	51 12	52 7	20
	4	81 10	57.60	47 1	46 4	
3. R. Gillies, Castlecary Mills, Bonnybridge	3	89 13	57.66	51 12	52 12	21
	4	81 10	57.60	47 1	46 8	

The two animals which were submitted to the examination of the competitors on Wednesday were in only middling condition. Of the 106 estimates, three-fifths were 58 lb. on an average over the actual weight, and two-fifths were on an average 41 lb. under it, four being exactly correct with one animal out of the whole number.

The following analysis of the estimates sent in may be of interest:—

Competitors.	Average error in lb.
36½ per cent	15
28½ "	42
19½ "	70
15½ "	128

If, for ease of calculation, it is presumed that these animals were worth 56s. per cwt. or 6d. per lb., the errors of the different competitors would be as under:—

Competitors.	Average error in money.
36½ per cent	£0 7 6
28½ "	1 1 0
19½ "	1 15 0
15½ "	3 4 0

It therefore seems that of the farmers handing in estimates of the dead-weight of these animals, two out of every three men were on an average 36s. wrong on an animal worth £14. It is pleasing to know that one out of every three could estimate the value of these animals to within 7s. 6d., but of the others it may be said that in ordinary selling they are largely at the mercy of the butcher or dealer, who knows this part of the business very much better than the farmer does.

On Thursday the cattle, whose weight the competitors were asked to estimate, were well forward in condition. An examination of the papers for that day showed that two-thirds of the competitors were under the actual weight in their estimate, and about one-third over it. This was almost exactly the reverse of what had happened on the previous day. On that occasion the animals were not in much better than good store condition, with the result that the bulk of the competitors over-estimated their weight; but on the second day, when the cattle were well finished, two-thirds of the farmers under-estimated their weight. These results would seem to show that farmers generally buy their stores for more than their real weight, and sell their fat cattle for less than they actually weigh. The following is an analysis of the estimates sent in on the Thursday:—

Competitors.	Average error in lb.
30½ per cent	12½
12½ "	34
11½ "	50
20 "	70
10½ "	97
15 "	179

Taking the value as before at 6d. per lb. (for ease of calculation), the one animal would be worth £18, 3s., and the other £16, 9s. 6d.; and calculating the errors of the different competitors at the same rate, it is shown below how necessary it is for the average farmer to sell by live-weight rather than to rely solely on his own judgment:—

Competitors.	Average error in money.
30½ per cent	£0 6 3
12½ "	0 17 0
11½ "	1 5 0
20 "	1 15 0
10½ "	2 8 6
15 "	4 9 6

It is pleasing to note that, as on the previous day, nearly one-third of the competitors estimated the value of these animals to within 6s. 3d. of their actual value; but the remainder were so wide of the mark, as to leave a profit for

several dealing men between the real value and their own estimate.

Those who are opposed to the adoption of the system of selling by live-weight, might argue that the competitors who sent in these estimates were not farmers of average intelligence or experience. It is, however, well known to those who had charge of the competition that such is not the case, the competitors being generally well-to-do farmers from all parts of the country. The majority of those who competed were men who believed they knew well the weight of a fat beast, and consequently thought they had a chance of gaining one of the prizes. What has happened here is very nearly a repetition of what has occurred at every block-test competition elsewhere, the obvious inference being that the average farmer is placed at a disadvantage in selling fat stock by his judgment alone.

The thanks of the Society are due to Messrs John Swan & Sons for supplying the animals for the "block-test."

Implements.

There can hardly be any doubt that the display of implements was the best as well as the largest at any of the Shows of the Society. Nearly all the leading firms in the kingdom were represented; and it is gratifying to be able to report that an unusually large amount of business was done.

The Stewards were authorised to examine the oil-engines in the Show. They report that the following were exhibited—viz.: 3-horse-power engine by Thos. Campbell, Gas-Engine Co., Limited, Halifax; 6½-horse-power engine by Messrs Crossley Brothers, Limited, Manchester; 6½-horse-power engine by Messrs Hornsby & Sons, Limited, Grantham; 7-horse-power engine by Messrs Priestman Brothers, Limited, Hull; 2-horse-power engine by Messrs R. Stephenson & Co., Limited, Newcastle-on-Tyne; and a 3-horse-power engine by Messrs Weyman & Hitchcock, Limited, Guildford. The Stewards were favourably impressed with the working of all those engines. It will be noticed that they vary from 2- to 7-horse-power. As indicating the cheapness of oil-engines as motors, it may be mentioned that they consume only about three-fourths of a pint of oil per break-horse-power per hour, the price of the oil being from 3d. to 4½d. per gallon. These engines require very little attention in working, and are admirably adapted for such purposes as threshing, chaff-cutting, grinding, cream-separating, &c.

A cow-milking appliance for hand-power was exhibited at work in the Showyard by Messrs Struthers, Weir, & Co., Hamilton Street, Carluke. On the recommendation of the Stewards, a silver medal was awarded for the appliance.

PREMIUMS AWARDED BY THE SOCIETY IN 1893

I.—EDINBURGH SHOW

25th, 26th, 27th, and 28th July 1893

ABBREVIATIONS.—V. H. C., *Very Highly Commended.* H. C., *Highly Commended.* C., *Commended.*

CATTLE

Champion Cup, value £10, for most points in Prizes for the Shorthorn, Aberdeen-Angus, Galloway, West Highland, and Ayrshire Breeds of Cattle. Given by H.R.H. THE DUKE OF YORK, K.G.

Conditions.—A First Prize shall count three points, a Second Prize two points, and a Third Prize one point. In the event of a tie, most First Prizes shall carry. The Competition shall be confined to the ordinary Class Prizes offered by the Society. An exhibitor shall not be entitled to count winnings in more than six Classes for one breed of Cattle. Only one Prize shall be counted for each animal, and all animals in Extra Stock Classes are excluded.

L. Pilkington, Cavens, Kirkbean, Dumfries, 18 points.
T. V. Smith of Ardtornish, Morvern, Oban, 18 points.

Mr Pilkington wins the Cup, having five first prizes to Mr Smith's four.

SHORTHORN.

THE TWEEDDALE GOLD MEDAL, Value £20, for the Best Shorthorn Bull in the Yard.

No. 4. The Earl of Feversham, Duncombe Park, Helmsley R.S.O., Yorkshire, "New Year's Gift" (57,796).

Best Bull of any age in Classes 1, 2, *and* 3—£20, given by the Shorthorn Society.

No. 4. The Earl of Feversham, Duncombe Park, Helmsley R.S.O., Yorkshire, "New Year's Gift" (57,796).

Breeder of best Bull of any age in Classes 1, 2, *and* 3—Silver Medal.

No. 4. Lord Lovat, Beaufort Castle, Beauly, N.B.

CLASS 1. BULL, calved before 1st January 1891.—Premiums, £15, £10, and £5.

1st. No. 4. The Earl of Feversham, Duncombe Park, Helmsley R.S.O., Yorkshire, "New Year's Gift" (57,796).
2d. No. 14. Her Majesty the Queen, The Prince Consort's Shaw Farm, Windsor, "Fairfax" (60,792).
3d. No. 8. George Harrison, Underpark, Lealholm, Grosmont, Yorks, "Lord Boycott" (57,587).
V.H.C. No. 13. Lord Polwarth, Mertoun House, St Boswells, "Bridegroom" (62,209).
H.C. No. 10. Thomas Lambert, Elrington Hall, Hexham, "Studley's Knight" (61,878).
C. No. 5. John Gilmour of Montrave, Leven, "Gem of Pennan" (59,002).

CLASS 2. BULL, calved on or after 1st January 1891.—
Premiums, £15, £10, and £5.

1st. No. 22. W. Graham, Eden Grove, Kirkbythore, Penrith, "Fairy King" (62,570).
2d. No. 33. John Vickers, Catchburn, Morpeth, "Golden King" (62,663).
3d. No. 24. Arthur B. Law, Mains of Sanquhar, Forres, "Sanquhar" (63,336).
V.H.C. No. 18. William Atkinson, Overthwaite, Milnthorpe, Westmoreland, "Asterisk" (62,094).
H.C. No. 32. Robert Thompson, Inglewood, Penrith, Cumberland, "British Cheer" (62,222).
C. No. 20. J. Douglas Fletcher, of Rosehaugh, Inverness, "Samson."

CLASS 3. BULL, calved on or after 1st January 1892.—Premiums, £12, £8, and £4.

1st. No. 48. The Earl of Rosebery, Dalmeny Park, Linlithgowshire, "Sittyton Seal."
2d. No. 40. Donald Maclennan, 42 Sackville Street, Piccadilly, London, W., "Lofty."
3d. No. 37. John Gilmour, of Montrave, Leven, "Master of the Ring."
V.H.C. No. 43. The Duke of Northumberland, Alnwick Castle, Alnwick, "Prince Arthur."
H.C. No. 41. D. Maclennan, 42 Sackville Street, Piccadilly, London, W., "Red Duke."

CLASS 4. COW, of any age.—Premiums, £12, £8, and £4.

1st. No. 50. Lord Brougham and Vaux, Brougham, Penrith, "Rose of Wasdale."
2d. No. 51. Lord Brougham and Vaux, Brougham, Penrith, "Queen Catherine."
3d. No. 54. Edward Ecroyd, Lowhouse, Armathwaite R.S.O., Carlisle, "Armathwaite Rose."
V.H.C. No. 58. James M'William, Stoneytown, Keith, "Lady Mary."

CLASS 5. HEIFER, calved on or after 1st January 1891.—
Premiums, £10, £5, and £3.

1st. No. 65. George Harrison, Underpark, Lealholm, Grosmont, Yorks, "Warfare."
2d. No. 68. Her Majesty the Queen, Shaw Farm, Windsor, "Boquet."
3d. No. 67. Lord Polwarth, Mertoun House, St Boswells, "Wavemist."
V.H.C. No. 66. James M'William, Stoneytown, Keith, "Golden Seal."
H.C. No. 63. Alexander M. Gordon, of Newton, Insch, "Butterscotch."
C. No. 64. William Graham, Edengrove, Kirkbythore, Penrith, "Laurestina 37th."

CLASS 6. HEIFER, calved on or after 1st January 1892.—
Premiums, £10, £5, and £3.

1st. No. 90. Robert Thompson, Inglewood, Penrith, Cumberland, "Sweet Shape."
2d. No. 84. Lord Polwarth, Mertoun House, St Boswells, "Bridal Robe."
3d. No. 82. James M'William, Stoneytown, Keith, "Sunbeam 2d."
V.H.C. No. 88. Her Majesty the Queen, Shaw Farm, Windsor, "Nosegay."
H.C. No. 79. Alexander M. Gordon, of Newton, Insch, "Buttermilk."
C. No. 91. Robert Turner, Cairnton of Boyndie, Portsoy, "Lady of the Ring."

ABERDEEN-ANGUS.

Best Bull of any age in Classes 7, 8, *and* 9—Ballindalloch Challenge Cup, value £50, given by Mr Macpherson Grant of Drumduan. The Cup shall be held by the winner for one year, and shall become the property of the Exhibitor who shall win it five times, not necessarily in succession.

No. 109. Sir George Macpherson Grant, Bart., Home Farm, Ballindalloch, "Eltham" (9120).

Best Bull of any age in Classes 7, 8, *and* 9—Gold Medal, value £8, 10s., given by the Polled Cattle Society.

No. 109. Sir George Macpherson Grant, Bart., Home Farm, Ballindalloch, "Eltham" (9120).

Breeder of best Bull of any age in Classes 7, 8, *and* 9—Silver Medal.

No. 109. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch.

CLASS 7. BULL, calved before 1st December 1890.—Premiums, £15, £10, and £5.

1st. No. 94. C. Bolden, Preston Bisset, Buckingham, "Esmond of Ballindalloch" (8304).
2d. No. 97. Sir George Macpherson Grant, Bart., Home Farm, Ballindalloch, "Prince Iliad" (7091).
3d. No. 104. John Stuart, Stonehurst, Ardingly, Sussex, "Financier of Ballindalloch" (8328).
V.H.C. No. 98. John Grant, Advie Mains, Advie, "Rustler" (8761).
H.C. No. 96. Arthur Egginton, South Ella, Hull, "Ensign of Guisachan" (6011).
C. No. 103. David Kinnear Stephen, Commieston, Montrose, "Eric of Lauriston" (7509).

CLASS 8. BULL, calved on or after 1st December 1890.—Premiums, £15, £10, and £5.

1st. No. 109. Sir George Macpherson Grant, Bart., Home Farm, Ballindalloch, "Eltham" (9120).
2d. No. 113. The Earl of Rosebery, Dalmeny Park, Linlithgowshire, "Marquis of Moray" (9387).
3d. No. 110. Marquis of Huntly, Aboyne Castle, Aboyne, "Privateer" (9550).
V.H.C. No. 106. Fred. Crisp, White House, New Southgate, "Gilderoy" (9208).
H.C. No. 117. James Wilson, Inchgower, Fochabers, "Savannah" (10,455).
C. No. 108. J. Douglas Fletcher of Rosehaugh, Inverness, "Minotaur of Rosehaugh" (9421).

CLASS 9. BULL, calved on or after 1st December 1891.—Premiums, £12, £8, and £4.

1st. No. 119. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch, "Eurotas of Ballindalloch" (9962).
2d. No. 121. William Whyte, Spott, Kirriemuir, "Angus Macdonald" (9763).
3d. No. 118. J. Douglas Fletcher of Rosehaugh, Inverness, "Bullion" (9839).
H.C. No. 120. Marquis of Huntly, Aboyne Castle, Aboyne, "Birse More."
C. No. 122. George Willsher, Pitpointie, Auchterhouse, Dundee, "Hector of Pitpointie (10,049).

Best Cow of any age in Classes 10 *and* 11—Ballindalloch Challenge Cup, value £50, given by Mr Macpherson Grant of Drumduan. The Cup shall be held by the winner for one year, and shall become the property of the Exhibitor who shall win it five times, not necessarily in succession.

No. 124. Arthur Egginton, South Ella, Hull, "Equality" (11,208).

Breeder of best Cow of any age in Classes 10 *and* 11—Silver Medal.

No. 124. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch.

Best Female Animal in Classes 10, 11, 12, *and* 13—Gold Medal, value £8, 10s., given by the Polled Cattle Society.

No. 124. Arthur Egginton, South Ella, Hull, "Equality" (11,208).

CLASS 10. COW, calved before 1st December 1889.—Premiums, £12, £8, and £4.

1st. No. 124. Arthur Egginton, South Ella, Hull, "Equality" (11,208).
2d. No. 127. John Grant, Advie Mains, Advie, "Ladybird" (13,727).
3d. No. 125. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch, "Eurya" (13,708).
V.H.C. No. 126. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch, "Gemista" (15,051).
H.C. No. 128. The Marquis of Huntly, Aboyne Castle, Aboyne, "St Agatha" (13,838).
C. No. 123. Thomas Dixon, jun., Leadhill, Stocksfield-on-Tyne, "Lady Florid" (15,055).
C. No. 132. Thomas Smith, Powrie, Dundee, "Ruby 18th of Powrie" (15,638).

CLASS 11. COW, three years old.—Premiums, £12, £8, and £4, given by Mr Macpherson Grant of Drumduan.

1st. No. 136. George Smith Grant, Auchorachan, Glenlivet, Ballindalloch, "Legend" (16,518).

2d. No. 135. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch, "Rose of the Vicarage" (16,508).
3d. No. 140. Thomas Smith, Powrie, Dundee, "Witch of Endor 15th" (18,522).
V.H.C. No. 137. William Robertson, Linkwood, Elgin, "Pride of Moray" (17,044).
H.C. No. 141. The Earl of Strathmore, Home Farm, Glamis Castle, Glamis, "Milkmaid of Glamis" (17,264).
C. No. 134. Robert Forbes, Woodhead, Kinloss, Forres, "Queen 2d of Lynemore" (17,835).

CLASS 12. HEIFER, calved on or after 1st December 1890.—
Premiums, £10, £5, and £3.

1st. No. 143. Miss Morison Duncan, Naughton, Dundee, "Elena of Naughton" (17,774).
2d. No. 153. William Whyte, Spott, Kirriemuir, "Rarity" (18,683).
3d. No. 149. The Countess Dowager of Seafield, Cullen House, Cullen, "Arizona" (18,412).
V.H.C. No. 152. William Whyte, Spott, Kirriemuir, "Judy 4th" (18,677).
H.C. No. 150. Thomas Smith, Powrie, Dundee, "Pride of Powrie 3d" (18,518).
C. No. 151. Thomas Smith, Powrie, Dundee, "Ruby 26th of Powrie" (18,521).

CLASS 13. HEIFER, calved on or after 1st December 1891.—
Premiums, £10, £5, and £3.

1st. No. 161. Sir George Macpherson Grant, Bart., Ballindalloch Castle, Ballindalloch, "Gentian of Ballindalloch" (19,258).
2d. No. 167. The Earl of Rosebery, Dalmeny Park, Linlithgowshire, "Grace of Dalmeny" (19,733).
3d. No. 157. George Bruce, Tochineal, Cullen, "Rest 3d of Drummuir" (19,100).
V.H.C. No. 158. Miss Morison Duncan, Naughton, Dundee, "Naomi of Naughton" (19,116).
H.C. No. 163. John Grant, Advie Mains, Advie, "Melody."
C. No. 155. C. Bolden, Preston Bissett, Buckingham, "Pride of Preston 4th" (18,884).
C. No. 159. Arthur Egginton, South Ella, Hull, "Equivalent" (19,127).
C. No. 173. The Earl of Strathmore, Home Farm, Glamis Castle, Glamis, "Fraulein of Glamis" (19,899).

GALLOWAY.

Breeder of best Bull of any age in Sections 14, 15, *and* 16—Silver Medal.

No. 180. James Cunningham, Tarbreoch, Dalbeattie.

CLASS 14. BULL, calved before 1st January 1891.—Premiums, £15, £10, and £5.

1st. No. 180. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Henry of Tarbreoch" (4847).
2d. No. 179. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig Castle, Thornhill, "Indian Prince 2d" (5260).
3d. No. 178. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Viking" (5021).

CLASS 15. BULL, calved on or after 1st January 1891.—
Premiums, £15, £10, and £5.

1st. No. 182. Leonard Pilkington, Cavens, Kirkbean, by Dumfries, "Cedric 2d of Tarbreoch" (5483).
2d. No. 181. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Clanalpine 2d" (5486).

CLASS 16. BULL, calved on or after 1st January 1892.—
Premiums, £12, £8, and £4.

1st. No. 186. William Parkin-Moore, Whitehall, Mealsgate, Carlisle, "Macdougall 3d of Tarbreoch" (5840).
2d. No. 185. Christopher Graham, Harelawhill, Canonbie, "The Gladiator 2d" (5830).
3d. No. 187. H. G. Murray Stewart, of Cally, Gatehouse, "The Pathfinder 2d" (5838).

H.C. No. 184. Christopher Graham, Harelawhill, Canonbie, "Sir Graham 6th of Balgray" (5849).
C. No. 183. The Countess of Carlisle, Naworth Castle, Brampton, Cumberland, "Indian Chief" (5684).

CLASS 17. COW, of any age.—Premiums, £12, £8, and £4.

1st. No. 193. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Tidy 5th of Drumlanrig" (11,933).
2d. No. 192. James Cunningham, Tarbreoch, Dalbeattie, "Bell 3d of Drumhumphry" (10,633).
3d. No. 191. James Cunningham, Tarbreoch, Dalbeattie, "Madonna 2d of Tarbreoch" (11,056).
V.H.C. No. 188. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig Castle, Thornhill, "Peeress 6th" (10,953).
H.C. No. 189. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig Castle, Thornhill, "Atalanta 2d" (11,453).

CLASS 18. HEIFER, calved on or after 1st January 1891.—Premiums, £10, £5, and £3.

1st. No. 201. Sir Robert Jardine, Bart., of Castlemilk, Lockerbie, "Lady Vaudeville of Castlemilk" (12,936).
2d. No. 203. Leonard Pilkington, Cavens, Dumfries, "Isabel of Tarbreoch" (12,552).
3d. No. 196. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig Castle, Thornhill, "Pride 6th of Drumlanrig" (12,437).
V.H.C. No. 197. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig Castle, Thornhill, "Pride B of Drumlanrig" (12,436).
H.C. No. 194. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Caprice 8th" (12,751).
C. No. 200. Sir Robert Jardine, Bart., of Castlemilk, Lockerbie, "Lady Isabella Douglas 3d of Castlemilk" (12,468).

CLASS 19. HEIFER, calved on or after 1st January 1892.—Premiums, £10, £5, and £3.

1st. No. 209. Sir Robert Jardine, Bart., of Castlemilk, Lockerbie, "Mabel of Castlemilk" (12,950).
2d. No. 214. Lord Polwarth, Mertoun House, St Boswells, "Betsy of Mertoun."
3d. No. 210. Sir Robert Jardine, Bart., of Castlemilk, Lockerbie, "Victress of Castlemilk" (12,949).
V.H.C. No. 206. James Cunningham, Tarbreoch, Dalbeattie, "Sheba of Tarbreoch" (13,124).
H.C. No. 204. The Countess of Carlisle, Naworth Castle, Brampton, Cumberland, "Primrose 2d of Drumlanrig" (12,928).
C. No. 208. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig Castle, Thornhill, "Hannah 10th of Drumlanrig" (12,918).

HIGHLAND.

Best Bull in Classes 20, 21, *and* 22—£10, given by Mr Smith of Ardtornish.

No. 232. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Victor 7th."

Breeder of best Bull of any age in Classes 20, 21, *and* 22—Silver Medal.

No. 232. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire.

CLASS 20. BULL, calved before 1st January 1891.—Premiums, £15, £10, and £5.

1st. No. 223. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Victor 5th" (951).
2d. No. 218. J. R. Campbell, Shinniss, Lairg, "Donull Riabhach" (875).
3d. No. 222. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Bhaltair" (851).
V.H.C. No. 219. Alexander Macdonald, Balranald, Lochmaddy, "Tearlach Ruadh" (698).
H.C. No. 220. Alexander Macdonald, Balranald, Lochmaddy, "Rob" (935).
C. No. 221. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Fag-a-Bealach."
C. No. 224. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Duke of Berwick" (877).

CLASS 21. BULL, calved on or after 1st January 1891.—
Premiums, £15, £10, and £5.

1st. No. 232. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Victor 7th."
2d. No. 225. The Duke of Athole, K.T., Blair Castle, Blair Athole, "Adhollach."
3d. No. 226. J. Campbell, of Kilberry, Kilberry, Argyllshire, "Glenralloch" (896).
V.H.C. No. 231. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Valentine 5th."
H.C. No. 228. James Carnegie, of Stronvar, Lochearnhead R.S.O., "Calum Ruadh."
C. No. 229. Sir Donald Currie, K.C.M.G., M.P., of Garth and Glenlyon, Glenlyon House, Fortingall, "An Gaidheal Og of Garth."
C. No. 233. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Annandale" (839).

CLASS 22. BULL, calved on or after 1st January 1892.—
Premiums, £12, £8, and £4.

1st. No. 244. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Valentine 6th."
2d. No. 246. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Valentine 9th."
3d. No. 245. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Valentine 8th."
V.H.C. No. 240. J. Campbell, of Kilberry, Kilberry, Argyllshire, "Achnahard."
H.C. No. 239. The Marquis of Breadalbane, Taymouth Castle, Aberfeldy, "Young Rossie."
C. No. 241. J. Campbell, of Kilberry, Kilberry, Argyllshire, "Achaglachgach."

Best Female Animal in Classes 23, 24, *and* 25—£10, given by
Mr Smith of Ardtornish.

No. 268. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Sgiathach 6th."

CLASS 23. COW, of any age.—Premiums, £12, £8, and £4.

1st. No. 253. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Ruadh Mhor."
2d. No. 256. John Stewart, Bochastle, Callander, "Mairi Bhuidhe" (2321).
3d. No. 255. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Mary of Ardtornish" (1242).
V.H.C. No. 250. J. Campbell, of Kilberry, Kilberry, Argyllshire, "Baravalla" (932).
H.C. No. 251. James Carnegie, of Stronvar, Lochearnhead R.S.O., "Nodhar Mhor."
C. No. 252. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Proiseag 4th" (1576).

CLASS 24. HEIFER, calved on or after 1st January 1890.—
Premiums, £10, £5, and £3.

1st. No. 257. J. R. Campbell, Shinness, Lairg, "Mairi Ruadh."
2d. No. 261. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Cruinneag 2d."
3d. No. 262. John Stewart, Bochastle, Callander, "Fassie."
V.H.C. No. 258. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Ribhinn."
H.C. No. 263. John Stewart, Bochastle, Callander, "Abhcadarrach."
C. No. 259. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Mholag Ruadh."

CLASS 25. HEIFER, calved on or after 1st January 1891.—
Premiums, £10, £5, and £3.

1st. No. 268. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Sgiathach 6th."
2d. No. 265. Colonel Malcolm, of Poltalloch, Poltalloch, Lochgilphead, "Ealasaid."
3d. No. 266. Colonel Malcolm of Poltalloch, Poltalloch, Lochgilphead, "Nora O'g."
V.H.C. No. 267. Thomas Valentine Smith, of Ardtornish, Morvern, Argyllshire, "Amy 3d."

AYRSHIRE.

Best Bull in Classes 26, 27, and 28, entered in the Ayrshire Herd Book—Champion Cup, value £10, given by the Ayrshire Cattle Herd Book Society, assisted by Mr Cross of Knockdon and Mr Mitchell, Barcheskie.

No. 276. Hugh Drummond, Craighead, Mauchline, "Duke of Mauchline" (2680).

Breeder of best Bull of any age in Classes 26, 27, and 28—Silver Medal.

No. 276. Hugh Drummond, Craighead, Mauchline.

CLASS 26. BULL, calved before 1st January 1891.—Premiums, £15, £10, and £5.

1st. No. 274. R. Osborne, Wynholm, Lockerbie, "Cockie Leekie" (2626).
2d. No. 273. Robert Montgomerie, Lessnessock, Ochiltree, "Dreadnought" (2585).
3d. No. 270. Thomas Kerr, Kirkchrist, Kirkcudbright, "Auctioneer" (2158).
C. No. 272. Donald M'Laren, Middleton of Mugdock, Milngavie, "Pride of Avon."

CLASS 27. BULL, calved on or after 1st January 1891.—
Premiums, £12, £8, and £4.

1st. No. 276. Hugh Drummond, Craighead, Mauchline, "Duke of Mauchline" (2680).
2d. No. 277. Robert Montgomerie, Lessnessock, Ochiltree, "Lochiel" (2799).
3d. No. 279. Sir Mark J. Stewart, Bart., M.P., Southwick, Dumfries, "Hover's Heir" (2690).
C. No. 278. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Royal Stewart" (2678).

CLASS 28. BULL, calved on or after 1st January 1892.—Premiums, £8, £5, and £3.

1st. No. 282. Leonard Pilkington, Cavens, Kirkbean, by Dumfries, "Field Marshal."
2d. No. 283. Sir Mark J. Stewart, Bart., M.P., Southwick, Dumfries, "Risk Him" (2732).
3d. No. 280. Robert Mackinlay, Hillhouse, Sandilands, Lanark, "Duke of York."
C. No. 285. Robert Wardrop, Garlaff, Cumnock, "Blood for Ever" (2659).

Best Cow in Classes 29 and 30, entered in the Ayrshire Herd Book—Champion Cup, value £10, given by the Ayrshire Cattle Herd Book Society, assisted by Mr Cross of Knockdon and Mr Mitchell, Barcheskie.

No. 300. Robert Wilson, Manswraes, Bridge of Weir, "Mayflower 3d" (6561).

CLASS 29. COW (in Milk), of any age.—Premiums, £10, £7, and £3.

1st. No. 300. Robert Wilson, Manswraes, Bridge of Weir, "Mayflower 3d" (6561).
2d. No. 286. Alex. Cross, Knockdon, Maybole, "Primrose 8th of Knockdon" (6401).
3d. No. 299. Thomas Scott, Peathill, Chryston, Cadder, "Queen of Braidisholm."
V.H.C. No. 302. Robert Wilson, Manswraes, Bridge of Weir, "Brydie."
H.C. No. 301. Robert Wilson, Manswraes, Bridge of Weir, "Melrose 3d."
C. No. 291. Thos. Kerr, Kirkchrist, Kirkcudbright, "Bet 1st of Kirkchrist" (6622).

CLASS 30. COW, of any age, in Calf, or Heifer calved in 1890 in Calf and due to calve within one month of the first day of the Show.—Premiums, £10, £7, and £3.

1st. No. 305. Alexander Cross, Knockdon, Maybole, "Beauty of Holehouse" (6376).
2d. No. 309. John Stewart, 128 Bellfield Street, Glasgow, "Beauty."
3d. No. 306. Alex. Cross, Knockdon, Maybole, "Blanche 2d of Knockdon" (6392).
V.H.C. No. 308. James Risk, Drumbrae, Bridge of Allan, "Kate."
H.C. No. 311. Robert Wilson, Manswraes, Bridge of Weir, "Susie" (7743).

CLASS 31. HEIFER, calved on or after 1st January 1891.—
Premiums, £10, £5, and £3.

1st. No. 320. Robert Wardrop, Garlaff, Cumnock, "Lady Diana" (8540).
2d. No. 317. Sir Mark J. Stewart, Bart., M.P., Southwick, Dumfries, "Stately 2d of Southwick" (8095).
3d. No. 313. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Betty."
V.H.C. No. 314. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Woodbine."
H.C. No. 319. M. B. Thomson, Park, Renfrew, "Peggy of Park."
C. No. 312. Thomas Kerr, Kirkchrist, Kirkcudbright, "Snowflake of Kirkcrhist" (8126).

CLASS 32. HEIFER, calved on or after 1st January 1892.—Premiums, £8, £5, and £3.

1st. No. 326. Leonard Pilkington, Cavens, Dumfries, "Braw Lass."
2d. No. 323. Robert Mackinlay, Hillhouse, Sandilands, Lanark, "Blinkbonny."
3d. No. 331. Sir Mark J. Stewart, Bart., M.P., Southwick, Dumfries, "Bess 6th of Southwick."
V.H.C. No. 329. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Monica" (8500).
H.C. No. 322. Hugh Drummond, Craighead, Mauchline, "May Queen."
C. No. 330. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Armorel."

JERSEY.

CLASS 33. BULL, of any age.—Premiums, £10, £5, and £2, given by Breeders of Jersey Cattle in Scotland, and a few others, per Mr Wardlaw Ramsay.

1st. No. 337. Dowager Marchioness of Lansdowne, Meikleour, Perth, "Sylvanus."
2d. No. 334. W. E. Gilmour, Woodbank, Alexandria, N.B., "Rifleman" (1676).
3d. No. 341. John Watson of Earnock, Hamilton, "Major."
V.H.C. No. 335. Patrick L. Gray, Freelands, Ratho, "Charlie."
H.C. No. 338. Sir R. D. Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Brave Lad."
C. No. 340. R. G. Wardlaw Ramsay, Whitehill, Rosewell, Mid-Lothian, "Martagon."

CLASS 34. COW (in Milk), calved before 1891.—Premiums, £10, £4, and £2, given by Breeders of Jersey Cattle in Scotland, and a few others, per Mr Wardlaw Ramsay.

1st. No. 344. Miss L. Harvey, Eastmiln, Auchterarder, "Shiela of Ruthven."
2d. No. 347. Robert Maxwell, Torheads Farm, Neilsland Estate, Hamilton, "Bettie."
3d. No. 342. Mrs Callander of Prestonhall, Dalkeith, "Daffodil."
V.H.C. No. 343. Fitzroy C. Fletcher, Letham Grange, Arbroath, "Susie."
H.C. No. 348. Sir R. D. Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Maude."
C. No. 355. E. Home Stirling, Cairnbank, Duns, "Grizzle."

CLASS 35. HEIFER, in Milk or in Calf, calved in 1891.—Premiums, £8, £3, and £1, given by Breeders of Jersey Cattle in Scotland, and a few others, per Mr Wardlaw Ramsay.

1st. No. 359. Miss L. Harvey, Eastmiln, Auchterarder, "Silver of Ruthven."
2d. No. 357. Fitzroy C. Fletcher, Letham Grange, Arbroath, "Jubilee."
3d. No. 358. Patrick L. Gray, Freelands, Ratho, "Lily."
C. No. 361. Lord Polwarth, Mertoun House, St Boswells, "Buttercup 2d."

CLASS 36. HEIFER, calved in 1892. Premiums, £5 and £2, given by Breeders of Jersey Cattle in Scotland, and a few others, per Mr Wardlaw Ramsay.

1st. No. 366. Captain Baird Hay, Belton, Dunbar, "Daphne."
2d. No. 367. Thomas M'Dougal, Dalhousie Castle, Bonnyrigg, "Jessie."
V.H.C. No. 362. Mrs Callander of Prestonhall, Dalkeith, "Dianthus."
V.H.C. No. 369. Sir R. D. Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Narcissus."
H.C. No. 376. John Welsh of Moredun, Liberton, "Queen Mary."
C. No. 375. John Watson of Earnock, Hamilton, "Beauty."

EXTRA CATTLE.

The following was Highly Commended and a Minor Gold Medal awarded:—

No. 380. Countess Dowager of Seafield, Castle Grant, Grantown, Highland Ox, "Red Sandy."—£3, 6s.

HORSES

Champion Cup, value £10, for most points in Prizes for Horses. Given by H.R.H. The Duke of York, K.G.

Conditions.—A First Prize shall count three points, a Second Prize two points, and a Third Prize one point. In the event of a tie, most First Prizes shall carry. The Competition shall be confined to the ordinary Class Prizes offered by the Society. The Driving and Jumping Competitions shall be excluded from the Competitions for this Cup. Only one Prize shall be counted for each animal. Geldings and all animals in Extra Stock Classes are excluded.

John Gilmour, of Montrave, Leven, 13 points.
Marquis of Londonderry, 11 points.

FOR AGRICULTURAL PURPOSES.

Best Stallion in Classes 37, 38, 39, 40, *and* 41—Champion Premium of £10, given by Mr Lockhart, Mains of Airies.

No. 381. P. & W. Crawford, Eastfield House, Dumfries, "Prince of Carruchan" (8151).

Breeder of best Male Animal of any age in Classes 37, 38, 39, *and* 40—Silver Medal.

No. 381. John M'Caig, Challoch, Stranraer.

Class 37. STALLION, foaled before 1st January 1890.—Premiums, £15, £12, £8, and £4.

1st. No. 381. P. & W. Crawford, Eastfield House, Dumfries, "Prince of Carruchan" (8151).
2d. No. 391. William Renwick, Meadowfield, Corstorphine, "Prince Alexander" (8899).
3d. No. 392. D. Riddell, Blackhall, Paisley, "Clydesdale."
4th. No. 396. Alexander Scott, Berry Yards Farm, Upper Greenock, "Prince Wyben" (9364).
V.H.C. No. 383. Richard Dunn, Udston Cottage, Hamilton, "Master Robin" (8040).
H.C. No. 388. William Montgomery, Banks, Kirkcudbright, "MacCuaig" (8802).
C. No. 386. Alexander M'Robbie, Sunnyside, Aberdeen, "Prince William" (6713).

Class 38. ENTIRE COLT, foaled on or after 1st January 1890.—Premiums, £15, £12, £8, and £4.

1st. No. 412. Robert Spittal, Kenmuir Farm, Tollcross, Glasgow, "Summit."
2d. No. 402. William Graham, Eden Grove, Kirkbythore, Penrith, "Sir Harry" (9411).
3d. No. 398. George Bean, Balquhain Mains, Pitcaple, "Prince Baldwin" (9359).
4th. No. 411. Thomas Smith, Blacon Point, Chester, "Macvinnie" (9318).
V.H.C. No. 400. J. Douglas Fletcher of Rosehaugh, Inverness, "Prince Albert of Rosehaugh" (9357).
H.C. No. 399. P. & W. Crawford, Eastfield House, Dumfries, "Darnley Again" (9182).
C. No. 408. John Pollock, Paper Mill, Langside, Glasgow, "Sir John Maxwell" (9415).

Class 39. ENTIRE COLT, foaled on or after 1st January 1891.—Premiums, £15, £10, £6, and £3.

1st. No. 420. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, "Holyrood" (9546).
2d. No. 422. William Montgomery, Banks, Kirkcudbright, "Montrave Dudley" (9621).
3d. No. 416. P. & W. Crawford, Eastfield House, Dumfries, "Gold Mine" (9540).
4th. No. 427. D. Riddell, Blackhall, Paisley, "Lord Wolseley."
V.H.C. No. 423. W. S. Park, Hatton, Bishopton, "Prince of Erskine."
H.C. No. 428. Alexander Scott, Berry Yards Farm, Upper Greenock, "Duke of Clarence" (9519).
C. No. 424. John Pollock, Paper Mill, Langside, Glasgow, "Kintyre" (9561).

CLASS 40. ENTIRE COLT, foaled on or after 1st January 1892.—
Premiums, £12, £7, £4, and £2.

1st. No. 432. William Clark, Netherlea, Cathcart, "Royal Gartly."
2d. No. 448. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Royal Standard."
3d. No. 446. Wm. Park, Brunstane, Portobello, "Prince of Brunstane."
4th. No. 452. Thomas Smith, Blacon Point, Chester, "Montrave President."
V.H.C. No. 436. John Duncan, Rhubodach, Rothesay, "Prince Rosemount."
H.C. No. 439. James Johnston, Lambhill House, Maryhill, "Vanguard."
C. No. 437. Richard Dunn, Udston Cottage Farm, Hamilton, "Cock Robin."

CLASS 41. Derby of 1893. Entries closed 31st January 1893. YEARLING COLT.
—Premiums, £5, £4, £3, and £1. (15 *Entries.*)

1st. No. 446. William Park, Brunstane, Portobello.
2d. No. 438. Fergusson & Menzies, Cults, Castle Kennedy.
3d. No. 453. Colonel Stirling, of Kippendavie, Dunblane.

Best Mare or Filly registered in the Clydesdale Stud-Book—Cawdor Challenge Cup, value 50 guineas, given by the Clydesdale Horse Society. The Cup must be won three times by an Exhibitor (but not necessarily in consecutive years or with the same animal) before it becomes his absolute property.

No. 479. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Queen of the Roses."

CLASS 42. MARE, of any age, with Foal at foot.—
Premiums, £15, £10, £5, and £3.

1st. No. 460. John Gilmour, of Montrave, Leven, "Montrave Maud."
2d. No. 454. George Alston, Loudounhill, Darvel, "Vanora" (9348).
3d. No. 457. W. H. Lumsden, Balmedie, Aberdeen "Maggie 5th" (10,627).
4th. No. 458. Sir R. D. Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Purdomstown Queen" (10,129).

CLASS 43. YELD MARE, foaled before 1st January 1890.—
Premiums, £10, £6, £3, and £2.

1st. No. 464. David Mitchell, Millfield, Polmont, "Sunray."
2d. No. 462. Robert J. Craig, Innerwell, Garlieston, Wigtownshire, "Bridesmaid"
3d. No. 465. David Mitchell, Millfield, Polmont, "Princess Adino."
4th. No. 467. William Park, Brunstane, Portobello, "Lady Lothian."
V.H.C. No. 471. John Russell, Craigie House, Ayr, "Princess Ariel" (11,240).
H. C. No. 470. Lord Polwarth, Mertoun House, St Boswells, "Comfort" (10,957).
C. No. 469. Lord Polwarth, Mertoun House, St Boswells, "Clara of Mertoun" (10,101).

CLASS 44. FILLY, foaled on or after 1st January 1890.—
Premiums, £10, £6, £3, and £2.

1st. No. 479. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Queen of the Roses."
2d. No. 478. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Crown Imperial."
3d. No. 473. John Gilmour, of Montrave, Leven, "Lady Muriel."
4th. No. 476. David Mitchell, Millfield, Polmont, "Maritana" (8406).
V.H.C., No. 474. W. H. Lumsden, of Balmedie, Aberdeen, "Queenie Flashwood."
H.C. No. 475. David Mitchell, Millfield, Polmont, "Lily Langtry."
C. No. 480. Colonel Stirling, of Kippendavie, Dunblane, "Lady Grace Rowan."

CLASS 45. FILLY, foaled on or after 1st January 1891.—
Premiums, £10, £6, £3, and £2.

1st. No. 488. John Gilmour, of Montrave, Leven, "Dukina."
2d. No. 486. Robert Frederick, Drumflower, Dunragit, "White Rose."
3d. No. 493. David Mitchell, Millfield, Polmont, "Ellen Terry."
4th. No. 487. William W. Galbraith, Croftfoot, Gartcosh, "Nada."
V.H.C. No. 490. William Graham, Eden Grove, Penrith, "Royal Rose."
H.C. No. 496. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Rival Belle."
C. No. 482. John Douglas, Braes o' Yetts, Kirkintilloch, "Lady Douglas."
C. No. 495. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Vesta."

CLASS 46. FILLY, foaled on or after 1st January 1892.—
Premiums, £10, £6, £3, and £2.

1st. No. 519. James F. Murdoch, East Hallside Farm, Newton, "Lady Lockhart."
2d. No. 508. John Gilmour, of Montrave, Leven, "Montrave Gladys."
3d. No. 518. Alexander Murdoch, Gartcraig, Shettleston, "Rosebush."
4th. No. 510. William Graham, Eden Grove, Penrith.

V.H.C. No. 512. W. H. Lumsden of Balmedie, Aberdeen, "My Lady."
H.C. No. 523. Leonard Pilkington, Cavens, Kirkbean, Dumfries, "Fairy Footstep."
C. No. 503. A. & R. Brownlie, Park, Earlston.
C. No. 528. George Stewart, Haulkerton Mains, Laurencekirk, "Princess of Haulkerton."

CLASS 47. Derby of 1893. Entries close 31st January 1893. YEARLING FILLY. —Premiums, £5, £4, £3, £2, and £1. (17 *Entries.*)

1st. No. 508 B. John Gilmour, of Montrave, Leven.
2d. No. 518 E. Alexander Murdoch, Gartcraig, Shettleston.
3d. No. 526 H. David Riddell, Blackhall, Paisley.
4th. No. 511 C. John Inch, Howburn, Biggar.
5th. No. 527 I. John Russell, Craigie House, Ayr.
V.H.C. No. 516. Sir Robert D. Moncreiffe, Bart., Moncreiffe House, Bridge of Earn.
H.C. No. 522 G. Leonard Pilkington, Gillfoot, Kirkbean.
H.C. No. 523. Leonard Pilkington, Cavens, Kirkbean, Dumfries.

ROAD OR FIELD.

CLASS 48. MARES, suitable for breeding Hunters, in foal to, or with foal at foot by, a Thoroughbred Horse serving in Scotland.—Premiums, £12, £8, £3, and £2, given by Mr Gilmour of Montrave.

1st. No. 536. John W. J. Paterson, Terrona, Langholm, "Gowanlea."
2d. No. 532. A. Alexander, Cockburn Hill, Balerno, "Lady Oswestry."
3d. No. 537. Lord Polwarth, Mertoun House, St Boswells, "Patch."
4th. No. 533. Hon. Lilian Elphinstone, Carberry Tower, Musselburgh, "Little Wonder."
C. No. 538. Lord Polwarth, Mertoun House, St Boswells, "Shepherdess."

Best Hunter in Classes 49 *and* 50—Champion Prize, £10.

No. 542. C. W. C. Henderson, The Riding, Hexham, Gelding, "Edwine."

CLASS 49. HUNTER, Mare or Gelding, 4 years old and upwards, up to 14 stones or upwards.—Premiums, £10, £5, and £3.

1st. No. 542. C. W. C. Henderson, The Riding, Hexham, Gelding, "Edwine."
2d. No. 541. John Gilmour, of Montrave, Leven, Gelding, "Nimrod."
3d. No. 540. George R. Fortune, Pilmuir, Largo, Gelding, "Royalty."
V.H.C. No. 543. James Kennedy, Chesters, New Kilpatrick, Gelding, "Scroope."

CLASS 50. HUNTER, MARE or GELDING, 4 years old or upwards, up to 12 stone. —Premiums, £10, £5, and £3.

1st. No. 556. Charles Liddell, Sandhoe High House, Hexham-on-Tyne, Gelding "Disturbance."
2d. No. 563. Charles Walker, W.S., 31 Howard Place, Edinburgh, Mare, "Duchess."
3d. No. 548. Robert Ainslie, Dodridge, Ford, Dalkeith, Gelding, "Hastings."
V.H.C. No. 550. George T. Brown, Brandraw House, Aspatria, Cumberland, Gelding, "Vinder."
C. No. 557. Lister M'Cutcheon, Caldewgate, Carlisle, Mare, "Hilda."
C. No. 560. James Robertson, Ladyrig, Roxburgh, Mare, "Tibby."

CLASS 51. MARE or GELDING, 3 years old.—Premiums, £10, £5, and £3.

1st. No. 570. Robert White, Outerston, Gorebridge, Gelding, "Tom."
2d. No. 568. Lord Polwarth, Mertoun House, St Boswells, Mare, "Orange Blossom."
3d. No. 566. John R. Hamilton, M.D., Elm House, Hawick, Gelding, "Koklau."
V.H.C. No. 564. John Agnew, Omoa Cottage, Clelland, Lanarkshire, Gelding, "Lobbin Gulla."

CLASS 52. MARE or GELDING, 2 years old.—Premiums, £8, £4, and £2.

1st. No. 580. Messrs Thompson & Sons, Kirkhouse, Milton, Carlisle, Mare, "Lady Marjory."
2d. No. 576. John Gilmour of Montrave, Leven, Gelding, "Rajah."
3d. No. 575. Allan Gilmour, yr. of Eaglesham, Eaglesham, Renfrewshire, Gelding, "Moiety."
V.H.C. No. 573. George Dove, Eccles House, Kelso, Mare, "Maxton."
C. No. 579. Lord Polwarth, Mertoun House, St Boswells, Gelding, "Black Prince."

CLASS 53. YEARLING COLT or FILLY, the produce of Thoroughbred Stallions that have served in Scotland, out of Mares of any breed.—Five Prizes—£10, £7, £5, £2, and £1, given by Captain G. D. Clayhills Henderson of Invergowrie, R.N.

1st. No. 585. John Gilmour of Montrave, Leven, Filly, "Canteen."
2d. No. 588. Captain Clayhills Henderson, R.N., Invergowrie, Dundee, Filly, "Princess Patricia."
3d. No. 584. John Gilmour of Montrave, Leven, Filly, "Carol."
4th. No. 583. Allan Gilmour, yr. of Eaglesham, Eaglesham, Renfrewshire, Filly, "Comet."
5th. No. 592. Thomas M. Skirving, Niddrie Mains, Edinburgh, Filly, "Mavourneen."
V.H.C. No. 581. A. Alexander, Cockburn Hill, Balerno, Gelding, "Red Rover."

HACKNEYS IN HAND OR SADDLE.

Best Hackney Stallion—Champion Prize of £10.

No. 654. A. W. Hickling, Wollaton, Nottingham, "Grand Cadet."

Best Female Registered Hackney in Classes 55, 56, 57, 58, 60, *and* 62—Champion Prize of £10.

No. 652. James Walker, Limefield, West Calder, "Dearest" (5214).

Best Animal in the Hackney Classes, registered in the Hackney Stud-Book—Gold Medal, value £15, given by the Hackney Horse Society.

No. 652. James Walker, Limefield, West Calder, "Dearest" (5214).

CLASS 54. STALLION, any Age, over 15 hands, registered in the Hackney Stud-Book.—Premiums, £10, £5, and £2.

1st. No. 595. Gavin Hadden, Dalmuinzie, Murtle, Aberdeenshire, "Challenger"—late "General Boulanger" (3013).
2d. No. 594. P. & W. Crawford, Eastfield House, Dumfries, "Dash It All" (4220).
3d. No. 597. Alexander Murdoch, Auchenflower, Ballantrae, Ayrshire, "Tormentor" (1356).

CLASS 55. BROOD MARE, registered in the Hackney Stud-Book, with Foal at foot, or to foal this season to a registered sire.—Premiums, £7, £4, and £2.

1st. No. 604. Alexander Morton, Gowanbank, Darvel, Ayrshire, "Florence" (660).
2d. No. 607. W. & T. Scott, Somerville Place, Carluke, "Nell Gwynne" (3128).
3d. No. 601. Charles E. Galbraith, Ayton Castle, Ayton, "Lady Alice" (1170).
V.H.C. No. 603. A. W. Hickling, Wollaton, Nottingham, "Lady Sarah" (2963).
H.C. No. 600. A. H. Boyle, Ruchill House, Maryhill, "Dorothy."
C. No. 605. Alexander Morton, Gowanbank, Darvel, Ayrshire, "Lady Derby" (2890).

CLASS 56. MARE or GELDING, 4 years old and upwards, 15 hands and upwards.—Premiums, £6, £4, and £2.

1st. No. 615. Andrew Hunter, Braehead House, Cathcart, Mare, "Lady Lofty" (5594).
2d. No. 619. Alexander Scott, Berry Yards Farm, Upper Greenock, Mare, "Ravely" (6080).
3d. No. 609. P. & W. Crawford, Eastfield House, Dumfries, Mare, "Latest Novel."
V.H.C. No. 613. Miss Houldsworth, of Coltness, Wishaw, Mare, "Griselda."
H.C. No. 616. Duncan Jenkins, The Cross, Govan, Gelding, "Scottie."

CLASS 57. MARE or GELDING, 4 years old and upwards, 14½ and under 15 hands.—Premiums, £6, £4, and £2.

1st. No. 625. A. W. Hickling, Wollaton, Nottingham, Mare, "Mascotte" (1706).
2d. No. 629. Charles W. Scott, Woodbank, Dumfries, Mare, "Oakleigh Confidence" (3147).
3d. No. 631. William C. Weir, 10 Princes Terrace, Dowanhill, Glasgow, Gelding, "Lanikin."
V.H.C. No. 626. David Mitchell, Millfield, Polmont, Mare, "Brown Berry" (1463).
H.C. No. 620. J. Harriott Bell, Rossie House, Forgandenny, Mare, "Ophelia," (5956).
C. No. 628. Alexander Scott, Berry Yards Farm, Upper Greenock, Gelding, "Chieftain."

CLASS 58. MARE or GELDING, 3 years old.—Premiums, £5, £3, and £1.

1st. No. 633. A. H. Boyle, Ruchill House, Maryhill, Mare, "Twilight" (4819).
2d. No. 637. W. & T. Scott, Somerville Place, Carluke, Mare, "Gillyflower" (3856).
3d. No. 635. Andrew Hunter, Braehead House, Cathcart, Mare, "Precocia" (4572).
V.H.C. No. 634. Charles E. Galbraith, Ayton Castle, Ayton, Filly, "Lady Preston" (4166).
H.C. No. 636. Alexander Scott, Berry Yards Farm, Upper Greenock, Mare, "Lady May."
C. No. 632. A. Alexander, Cockburn Hill, Balerno, Mare, "Miss Cockburn."

CLASS 59. COLT or GELDING, two years old.—Premiums, £5, £3, and £1.

1st. No. 639. P. & W. Crawford, Eastfield House, Dumfries, Stallion, "King Jim."
2d. No. 640. Charles E. Galbraith, Ayton Castle, Ayton, Stallion, "Sussex."
3d. No. 642. Alex. Morton, Gowanbank, Darvel, Stallion, "Baccarat" (4124).
C. No. 638. W. J. P. Beattie, Newbie Villa, Annan, Stallion, "Golden Horn."
C. No. 641. Duncan Jenkins, The Cross, Govan, Stallion, "Campania" (4169).

CLASS 60. FILLY, two years old.—Premiums, £5, £3, and £1.

1st. No. 652. James Walker, Limefield, West Calder, "Dearest" (5214).
2d. No. 651. W. & T. Scott, Somerville Place, Carluke, "Waitress" (6289).
3d. No. 650. Alex. Morton, Gowanbank, Darvel, "Jessie o' the Dell" (5452).
V.H.C. No. 647. A. W. Hickling, Wollaton, Nottingham, "Sylvia" (6225).
H.C. No. 649. David Mitchell, Millfield, Polmont, "Belle of the Ball."
C. No. 644. J. Clark Forrest, Udston, Hamilton, "Daybreak."

CLASS 61. COLT, one year old.—Premiums, £5, £3, and £1.

1st. No. 654. A. W. Hickling, Wollaton, Nottingham, "Grand Cadet."
2d. No. 657. Alexander Leslie of Braco, Keith, "Imperial."
3d. No. 658. J. A. Mather, Grovehill Stud Farm, Thornhill, Dumfriesshire, "Monarchy."
V.H.C. No. 660. David Mitchell, Millfield, Polmont, "Lord Darvel."
H.C. No. 662. Gordon Reid Shiach, L.D.S., Ed., 1 N. Guildry Street, Elgin, "Lucifer 2d."

CLASS 62. FILLY, one year old.—Premiums, £5, £3, and £1.

1st. No. 664. Charles E. Galbraith, Ayton Castle, Ayton, "Lady Torfrida."
2d. No. 666. John M. Martin, Auchendennan, Balloch, "Lady Glencoe."
3d. No. 668. David Mitchell, Millfield, Polmont, "Lady Morton."
C. No. 663. Arthur Caird, Drumslea, Greenock, "May."
C. No. 667. J. A. Mather, Grovehill Stud Farm, Thornhill, Dumfriesshire, "Candy."

TURNS-OUT.

Classes 63 *and* 64, *see page* 494.

PONIES.

CLASS 65. STALLION, over 12, not exceeding 15 hands.—
Premiums, £4, £2, and £1.

1st. No. 674. A. H. Boyle, Ruchill House, Maryhill, "Bay-Fireaway 3d" (3439).
2d. No. 675. J. Hugh Mackenzie, Fracadal, Tobermory, Mull, "The Syrian."

CLASS 66. MARE or GELDING, between 13 and 14½ hands.—Premiums, £4, £2, and £1.

1st. No. 679. William Cree, Gifford, Haddington, Gelding, "Silver."
2d. No. 685. David Mitchell, Millfield, Polmont, Mare, "Alice."
3d. No. 677. James Blyth, Ord House, Berwick-on-Tweed, Mare, "Miss Wentworth."
H.C. No. 683. Charles Liddell, Sandhoe High House, Hexham-on-Tyne, Mare, "Molly Darling."

CLASS 67. MARE or GELDING, between 12 and 13 hands.—Premiums, £4, £2, and £1.

1st. No. 690. J. A. Mather, Grovehill Stud Farm, Thornhill, Dumfriesshire, Mare, "Princess."
2d. No. 689. Alexander C. Houston, Wester Walkinshaw, Paisley, Mare, "Peggy."
3d. No. 691. Donald T. Martin, Girgenti, Irvine, Mare, "Nugget."

CLASS 68. STALLION, under 12 hands.—Premiums, £4, £2, and £1.

1st. No. 693. James M'Meeken, Carnbooth, Busby, "Wildfire."
2d. No. 694. J. A. Mather, Grovehill Stud Farm, Thornhill, Dumfriesshire, "Tommy 2d" (2737).

CLASS 69. MARE or GELDING, under 12 hands.—Premiums, £4, £2, and £1.

1st. No. 696. Alex. C. Houston, Wester Walkinshaw, Paisley, Gelding, "Prince of Wales."
2d. No. 699. David Mitchell, Millfield, Polmont, Mare, "Activity."
3d. No. 695. J. Harriott Bell, Rossie House, Forgandenny, Mare, "Mousie."

CLASS 70. SHETLAND STALLION, above 3 years, not exceeding $10\frac{1}{2}$ hands.—Premiums, £4, £2, and £1.

1st. No. 703. James Bain & Son, Granton, Edinburgh, "Wallace."
2d. No. 707. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, "Harold."
3d. No. 706. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, "Thor" (83).
H.C. No. 705. The Ladies Hope, Longcross House, Chertsey, "Bay-Rum" (50).

CLASS 71. SHETLAND MARE or GELDING, above 3 years, not exceeding $10\frac{1}{2}$ hands.—Premiums, £4, £2, and £1.

1st. No. 711. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, Mare, "Thora" (212).
2d. No. 712. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, Mare, "Vesta" (215).
3d. No. 713. Andrew M'Farlane, Viewfield, Kingussie, Mare, "Rosie" (682).

CLASS 72. SHETLAND STALLION or MARE, under 3 years of age.—Premiums, £4 and £2, given by Mr C. Macpherson Grant of Drumduan, Mr Gavin Hadden of Dalmuinzie, and Mr George Bruce, Tochineal.

1st. No. 722. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, Mare, "Flora."
2d. No. 721. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, Mare, "Flip."
V.H.C. No. 720. Robert Kirkwood, Plough Inn, Camelon, Falkirk, Mare, "Molly."
H.C. No. 717. James Duncan, Fern Villa, Inverness, Stallion, "Rufus."

CLASS 73. Best Group of not less than Four SHETLAND PONIES shown in Classes 70, 71, and 72.—Premium, £4, 4s., given by Sir Allan Mackenzie, Bart.

No. A. The Marquis of Londonderry, Seaham Hall, Seaham Harbour, drawn from Classes 70, 71, and 72.

EXTRA HORSES.

The following were Very Highly Commended and Medium Gold Medals awarded:—

No. 723. Fitzroy C. Fletcher, Letham Grange, Arbroath, Thoroughbred Stallion, "Vale."—£5.
No. 725. W. H. Lumsden of Balmedie, Aberdeen, Clydesdale Mare, "Lady Dorothy" (8688).—£5.
No. 726. William Park, Brunstane, Portobello, Clydesdale Mare, "Polly" (11,556).—£5.
No. 727. D. Riddell, Blackhall, Paisley, Clydesdale Mare, "Sunrise."—£5.
No. 728. James Shepherd, Rossend Castle, Burntisland, American Trotting Stallion, "Alaska."—£5.

JUMPING.

Classes 74 *to* 79, *see pages* 494, 495.

SHEEP

Champion Cup, value £10, for most points in Prizes for Sheep.
Given by H.R.H. THE DUKE OF YORK, K.G.

Conditions.—A First Prize shall count three points, a Second Prize two points, and a Third Prize one point. In the event of a tie, most First Prizes shall carry. The Competition shall be confined to the ordinary Class Prizes offered by the Society. An exhibitor shall not be entitled to count winnings in more than four Classes for one breed of Sheep. Only one Prize shall be counted for each animal. Wethers, and all animals in Extra Stock Classes, are excluded.

David Buttar, Corston, Cupar-Angus, 21 points.
Chas. Howatson of Dornel, Glenbuck, 19 points.

BLACKFACED.

Best Ram of any age in Classes 80, 81, 82, *and* 83—£10, given by West of Scotland Breeders of Blackfaced Sheep, per Mr Howatson of Glenbuck.

No. 733. C. Howatson of Dornel, Glenbuck, N.B.

Sheep (entered in any class, Male or Female) carrying the fleece best adapted for protecting the animal in a high exposed and stormy climate—£2, £1, and 10s., given by Mr Howatson of Glenbuck.

1st. No. 748. R. & J. Cadzow, Borland, Biggar.
2d. No. 761. C. Howatson of Dornel, Glenbuck, N.B.
3d. No. 760. C. Howatson of Dornel, Glenbuck, N.B.

CLASS 80. TUP, three Shear or upwards.—Premiums, £10, £5, and £3.

1st. No. 731. C. Howatson of Dornel, Glenbuck, N.B.
2d. No. 732. C. Howatson of Dornel, Glenbuck, N.B.

CLASS 81. TUP, two Shear.—Premiums, £10, £5, and £3.

1st. No. 733. C. Howatson of Dornel, Glenbuck, N.B.
2d. No. 734. C. Howatson of Dornel, Glenbuck, N.B.
3d. No. 735. C. Howatson of Dornel, Glenbuck, N.B.
V.H.C. No. 740. Robert Watson, Culteraliers, Biggar.
H.C. No. 738. James D. Lawrie, Hopes, Gifford.

CLASS 82. SHEARLING TUP.—Premiums, £10, £5, and £3.

1st. No. 761. C. Howatson of Dornel, Glenbuck, N.B.
2d. No. 765. C. Howatson of Dornel, Glenbuck, N.B.
3d. No. 748. R. & J. Cadzow, Borland, Biggar.
V.H.C. No. 768. C. Howatson of Dornel, Glenbuck, N.B.
H.C. No. 747. R. & J. Cadzow, Borland, Biggar.
C. No. 762. C. Howatson of Dornel, Glenbuck, N.B.

CLASS 83. Five SHEARLING TUPS, bred and fed by Exhibitor.—Premiums, £4, £2, and £1, given by West of Scotland Breeders of Blackfaced Sheep, per Mr Howatson of Glenbuck.

1st. D Charles Howatson of Dornel, Glenbuck.
2d. B R. & J. Cadzow, Borland, Biggar.
3d. A The Duke of Argyll, K.G., Ballymenach, Campbeltown.
V.H.C. C John Craig, Southhalls, Strathaven.

CLASS 84. Three EWES, above one Shear, with their Lambs at foot.—Premiums, £8, £4, and £2.

1st. No. 793. Charles Howatson of Dornel, Glenbuck.
2d. No. 796. John Robson, Newton, Bellingham.
3d. No. 792. John Craig, Innergeldie, Comrie.

CLASS 85. TUP LAMB, bred and fed by Exhibitor.—Premiums, £3, £2, and £1, given by West of Scotland Breeders of Blackfaced Sheep, per Mr Howatson of Glenbuck.

1st. No. 798. D. T. Martin, Girgenti, Irvine.
2d. No. 797. D. T. Martin, Girgenti, Irvine.
3d. No. 799. John Robson, Newton, Bellingham.

CLASS 86. Three SHEARLING EWES or GIMMERS.—Premiums, £8, £4, and £2.

1st. No. 800. The Duke of Argyll, K.G., Ballymenach, Campbeltown.
2d. No. 804. Charles Howatson of Dornel, Glenbuck.
3d. No. 801. The Duke of Argyll, K.G., Ballymenach, Campbeltown.
V.H.C. No. 805. John Millar, Lambhill, Strathaven.
H.C. No. 802. John Craig, Innergeldie, Comrie.
C. No. 806. Lord Polwarth, Keithhill, Upper Keith.

CLASS 87. Pair TUPS, three Shear or upwards.—Premiums, £3, £2, and £1, given by Mr Howatson of Glenbuck.

1st. A. Charles Howatson of Dornel, Glenbuck.

CLASS 88. Pair TUPS, two Shear.—Premiums, £3, £2, and £1, given by Mr Howatson of Glenbuck.

1st. B. Charles Howatson of Dornel, Glenbuck.
2d. A. Charles Howatson of Dornel, Glenbuck.
3d. C. James D. Lawrie, Hopes, Gifford.

CLASS 89. Pair SHEARLING TUPS. Premiums, £3, £2, and £1, given by Mr Howatson of Glenbuck.

1st. H. Charles Howatson of Dornel, Glenbuck.
2d. I. Charles Howatson of Dornel, Glenbuck.
3d. G. R. & J. Cadzow, Borland, Biggar.
V.H.C. A. The Duke of Argyll, K.G., Ballymenach, Campbeltown.
H.C. E. John Craig, Southhalls, Strathaven.

CLASS 90. Pair TUP LAMBS.—Premiums, £3, £2, and £1, given by Mr Howatson of Glenbuck.

1st. No. 795 and 798. D. T. Martin, Girgenti, Irvine.
2d. No. 796. John Robson, Newton, Bellingham.

CLASS 91. Pair EWE LAMBS.—Premiums, £3, £2, and £1, given by Mr Howatson of Glenbuck.

1st. No. 808. Mrs Martin, Auchendennan, Balloch.
2d. No. 795. D. T. Martin, Girgenti, Irvine.
3d. No. 807. John Robson, Newton, Bellingham.

CHEVIOT.

CLASS 92. TUP, above one Shear.—Premiums, £10, £5, and £3.

1st. No. 810. George Douglas, Hindhope, Jedburgh.
2d. No. 820. James Moffat, Craick, Hawick.
3d. No. 818. John A. Johnstone, Archbank, Moffat.
V.H.C. No. 817. John A. Johnstone, Archbank, Moffat.
H.C. No. 828. John Smith, Mowhaugh, Yetholm.
C. No. 826. John Robson, Newton, Bellingham.

CLASS 93. SHEARLING TUP.—Premiums, £10, £5, and £3.

1st. No. 831. John Elliot, Hindhope, Jedburgh.
2d. No. 832. John Elliot, Hindhope, Jedburgh.
3d. No. 837. John A. Johnstone, Archbank, Moffat.
V.H.C. No. 836. John A. Johnstone, Archbank, Moffat.
H.C. No. 847. John Robson, Newton, Bellingham.
C. No. 834. John A. Johnstone, Archbank, Moffat.

CLASS 94. Three EWES, above one Shear, with their Lambs at foot.—Premiums, £8, £4, and £2.

1st. No. 852. John Robson, Newton, Bellingham.
2d. No. 851. John Robson, Newton, Bellingham.
3d. No. 849. Jacob Robson, Byrness, Otterburn, Northumberland.
V.H.C. No. 850. Jacob Robson, Byrness, Otterburn, Northumberland.

CLASS 95. Three SHEARLING EWES or GIMMERS.—Premiums, £8, £4, and £2.

1st. No. 855. John Robson, Newton, Bellingham.
2d. No. 853. Jacob Robson, Byrness, Otterburn, Northumberland.
3d. No. 854. Jacob Robson, Byrness, Otterburn, Northumberland.

BORDER LEICESTER.

CLASS 96. TUP, above one Shear.—Premiums, £10, £5, and £3.

1st. No. 861. Samuel Jack, Crichton Mains, Dalkeith.
2d. No. 858. Right Hon. Arthur James Balfour, M.P., Whittinghame, Prestonkirk.
3d. No. 857. Right Hon. Arthur James Balfour, M.P., Whittinghame, Prestonkirk.
V.H.C. No. 863. The Earl of Morton, Dalmahoy, Kirknewton.

CLASS 97. SHEARLING TUP.—Premiums, £10, £5, and £3.

1st. No. 879. Samuel Jack, Crichton Mains, Dalkeith.
2d. No. 871. Thomas Clark, Oldhamstocks Mains, Cockburnspath.
3d. No. 872. Thomas Clark, Oldhamstocks Mains, Cockburnspath.
V.H.C. No. 880. Samuel Jack, Crichton Mains, Dalkeith.
H.C. No. 873. Thomas Clark, Oldhamstocks Mains, Cockburnspath.
H.C. No. 887. John M. Twentyman, Hawkrigg House, Wigton, Cumberland.
C. No. 868. The Duke of Buccleuch and Queensberry, K.T., Dalkeith Park, Dalkeith.
C. No. 890. John M. Twentyman, Hawkrigg House, Wigton, Cumberland.

CLASS 98. Three EWES, above one Shear.—Premiums, £8, £4, and £2.

1st. No. 891. Right Hon. Arthur James Balfour, M.P., Whittinghame, Prestonkirk.
2d. No. 893. George Robeson, Springwells, Coldstream.
3d. No. 892. William Ford, Fenton Barns, Drem.
V.H.C. No. 894. The Earl of Rosebery, Dalmeny Park, Linlithgowshire.

CLASS 99. Three SHEARLING EWES or GIMMERS.—Premiums, £8, £4, and £2.

1st. No. 895. Right Hon. Arthur James Balfour, M.P., Whittinghame, Prestonkirk.
2d. No. 903. John M. Twentyman, Hawkrigg House, Wigton, Cumberland.
3d. No. 897. Thomas Clark, Oldhamstocks Mains, Cockburnspath.
V.H.C. No. 898. William Ford, Fenton Barns, Drem.
H.C. No. 901. George Robeson, Springwells, Coldstream.
C. No. 900. James Nisbet, Lambden, Greenlaw.

SHROPSHIRE.

CLASS 100. TUP, above one Shear.—Premiums, £6, £4, and £2.

1st. No. 905. David Buttar, Corston, Coupar-Angus.
2d. No. 909. John Wallace, Duniface, Leven.
3d. No. 906. Major Irwin, Lynehow, Carlisle.
C. No. 904. David Buttar, Corston, Cupar-Angus.

CLASS 101. SHEARLING TUP.—Premiums, £6, £4, and £2.

1st. No. 914. David Buttar, Corston, Coupar-Angus.
2d. No. 912. David Buttar, Corston, Coupar-Angus.
3d. No. 910. David Buttar, Corston, Coupar-Angus.
V.H.C. No. 911. David Buttar, Corston, Coupar-Angus.
H.C. No. 913. David Buttar, Corston, Coupar-Angus.
C. No. 915. David Buttar, Corston, Coupar-Angus.

CLASS 102. Three EWES, above one Shear.—Premiums, £5, £3, and £2.

1st. No. 929. David Buttar, Corston, Coupar-Angus.
2d. No. 930. David Buttar, Corston, Coupar-Angus.
3d. No. 928. David Buttar, Corston, Coupar-Angus.
H.C. No. 933. John Wallace, Duniface, Leven.
C. No. 931. Major Irwin, Lynehow, Carlisle.

CLASS 103. Three SHEARLING EWES or GIMMERS.—Premiums, £5, £3, and £2.

1st. No. 934. David Buttar, Corston, Coupar-Angus.
2d. No. 935. David Buttar, Corston, Coupar-Angus.
3d. No. 936. David Buttar, Corston, Coupar-Angus.
V.H.C. No. 942. The Earl of Strathmore, Home Farm, Glamis Castle, Glamis.
H.C. No. 939. Major Irwin, Lynehow, Carlisle.
C. No. 941. The Earl of Strathmore, Home Farm, Glamis Castle, Glamis.

CLASS 104. Three SHEARLING TUPS, bred in Scotland by Exhibitor.—Premiums, £3 and £2, given by Breeders of Shropshire Sheep in Scotland, per Mr Buttar.

1st. Nos. 910, 911, 914 A. David Buttar, Corston, Coupar-Angus.
2d. Nos. 912, 913, 915 B. David Buttar, Corston, Coupar-Angus.
C. Nos. 920, 922, 923 D. Lord Polwarth, Humbie House, Upper Keith.

CLASS 105. Three TUP LAMBS, bred in Scotland by Exhibitor.—Premiums, £3 and £2, given by Breeders of Shropshire Sheep in Scotland, per Mr Buttar.

1st. No. 944. David Buttar, Corston, Coupar-Angus.
2d. No. 945. David Buttar, Corston, Coupar-Angus.
C. No. 947. The Earl of Strathmore, Home Farm, Glamis Castle, Glamis.

CLASS 106. Three EWE LAMBS, bred in Scotland by Exhibitor.—Premiums, £3 and £2, given by Breeders of Shropshire Sheep in Scotland, per Mr Buttar.

1st. No. 948. David Buttar, Corston, Coupar-Angus.
2d. No. 949. David Buttar, Corston, Coupar-Angus.
H.C. No. 951. The Earl of Strathmore, Home Farm, Glamis Castle, Glamis.

OXFORD DOWN.

CLASS 107. TUP, above one Shear.—Premiums, £5 and £3.

1st. No. 952. Right Hon. A. J. Balfour of Whittinghame.
2d. No. 953. Hamlet Riley, Ennin, Penrith.
C. No. 954. John C. Toppin, Musgrave Hall, Penrith.

CLASS 108. SHEARLING TUP.—Premiums, £5 and £3.

1st. No. 958. Hamlet Riley, Ennin, Penrith.
2d. No. 956. Right Hon. A. J. Balfour of Whittinghame.
H.C. No. 959. John C. Toppin, Musgrave Hall, Penrith.

CLASS 109. Three EWES, above one Shear.—Premiums, £5 and £3.

1st. No. 962. Hamlet Riley, Ennin, Penrith.
2d. No. 963. John C. Toppin, Musgrave Hall, Penrith.
C. No. 960. Right Hon. A. J. Balfour of Whittinghame.

CLASS 110. Three SHEARLING EWES or GIMMERS.—Premiums, £5 and £3.

1st. No. 968. John C. Toppin, Musgrave Hall, Penrith.
2d. No. 967. Hamlet Riley, Ennin, Penrith.
C. No. 965. Right Hon. A. J. Balfour of Whittinghame.

HALF-BRED.

CLASS 111. TUP, above one Shear.—Premiums, £10, £5, and £3.

1st. No. 970. James Lawrence & Sons, Whytbank, Galashiels.
2d. No. 969. H. Hewat Craw, Rawburn, Duns.
3d. No. 971. James A. W. Mein, Hunthill, Jedburgh.

V.H.C. No. 972. James A. W. Mein, Hunthill, Jedburgh.
H.C. No. 974. Gideon Pott, Knowesouth, Jedburgh.
C. No. 973. Gideon Pott, Knowesouth, Jedburgh.

CLASS 112. SHEARLING TUP.—Premiums, £10, £5, and £3.

1st. No. 978. Andrew T. Elliot, Newhall, Galashiels.
2d. No. 977. Andrew T. Elliot, Newhall, Galashiels.
3d. No. 983. Sonmer Logan, Harrietfield, Kelso.
V.H.C. No. 979. Andrew T. Elliot, Newhall, Galashiels.
H.C. No. 980. Andrew T. Elliot, Newhall, Galashiels.
C. No. 975. John Bertram, Addinston, Lauder.

CLASS 113. Three EWES, above one Shear.—Premiums, £8, £4, and £2.

1st. No. 987. James A. W. Mein, Lamberton, Berwick-on-Tweed.
2d. No. 988. James A. W. Mein, Lamberton, Berwick-on-Tweed.
3d. No. 986. James Lawrence & Sons, Whytbank, Galashiels.
H.C. No. 989. Gideon Pott, Knowesouth, Jedburgh.
C. No. 990. White Brothers, Caddonlee, Galashiels.

CLASS 114. Three SHEARLING EWES or GIMMERS.—
Premiums, £8, £4, and £2.

1st. No. 996. James A. W. Mein, Lamberton, Berwick-on-Tweed.
2d. No. 1000. White Brothers, Caddonlee, Galashiels.
3d. No. 1001. William Young, Halkburn, Galashiels.
V.H.C. No. 997. James A. W. Mein, Lamberton, Berwick-on-Tweed.
H.C. No. 994. James Lawrence & Sons, Whytbank, Galashiels.
C. No. 993. Messrs Elliot, Harehead, Duns.

EXTRA SECTIONS.

CLASS 115. Three BLACKFACED WETHERS, one Shear.—Premiums, £4 and £2.

1st. No. 1005. John Gilmour of Lundin and Montrave, Leven.
Weight, 4 cwt. 0 qr. 15 lb.
2d. No. 1006. John Gilmour of Lundin and Montrave, Leven.
Weight, 4 cwt. 0 qr. 24 lb.
V.H.C. No. 1002. George Downie, Balcomie, Crail.
V.H.C. No. 1004. John Gilmour of Lundin and Montrave, Leven.
H.C. No. 1007. William Tod, Pardovan, Philipstoun.
C. No. 1003. George Downie, Balcomie, Crail.
C. No. 1008. William Tod, Pardovan, Philipstoun.

CLASS 116. Three CHEVIOT WETHERS, one Shear.—Premiums, £4 and £2.

1st. No. 1013. William Tod, Pardovan, Philipstoun. Weight, 5 cwt. 1 qr. 13 lb.
2d. No. 1014. William Tod, Pardovan, Philipstoun. Weight, 4 cwt. 3 qr. 4 lb.
V.H.C. No. 1012. Sir G. Graham Montgomery, Bart., Stobo Castle, Stobo.
H.C. No. 1010. John Gilmour of Lundin and Montrave, Leven.
C. No. 1009. John Gilmour of Lundin and Montrave, Leven.

CLASS 117. Three CROSS-BRED WETHERS, one Shear.—Premiums, £4 and £2.

1st. No. 1016. John Gilmour of Lundin and Montrave, Leven.
Weight, 5 cwt. 1 qr. 20 lb.
2d. No. 1015. F. W. Christie, Dairsie Mains, Cupar, Fife.
Weight, 5 cwt, 0 qr. 20 lb.
V.H.C. No. 1018. Alexander Guild, Greenhead, Pencaitland.
V.H.C. No. 1019. Sir G. Graham Montgomery, Bart., Stobo Castle, Stobo.
H.C. No. 1017. John Gilmour of Lundin and Montrave, Leven.

EXTRA SHEEP.

The following was Very Highly Commended and a Minor Gold Medal awarded:—

No. 1021. John Gilmour of Lundin and Montrave, Leven, 3 Shearling Wethers, Shropshire Cross. Weight, 5 cwt. 3 qr. 9 lb.—£3, 6s.

SWINE

LARGE WHITE BREED.

CLASS 118. BOAR.—Premiums, £4 and £2.

1st. No. 1027. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Dublin" (2680).
2d. No. 1025. Sommer Logan, Harrietfield, Kelso, "Harrietfield King" (2673).
V.H.C. No. 1024. The Earl of Haddington, Tyninghame, Prestonkirk, "Magistrate 2d."

CLASS 119. SOW.—Premiums, £4 and £2.

1st. No. 1031. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Giantess X."
2d. No. 1028. Somner Logan, Harrietfield, Kelso, "Harrietfield Lady Howard II." (3142).
H.C. No. 1029. Somner Logan, Harrietfield, Kelso, "Harrietfield Queen V." (2274).

CLASS 120. Three PIGS, not above 8 months old.—Premiums, £4 and £2.

1st. No. 1034. The Earl of Rosebery, Dalmeny Park, Linlithgowshire.
2d. No. 1035. Sanders Spencer, Holywell Manor, St Ives, Hunts.
H.C. No. 1032. Somner Logan, Harrietfield, Kelso.

WHITE BREED OTHER THAN LARGE.

CLASS 121. BOAR.—Premiums, £4 and £2.

1st. No. 1037. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Count."
2d. No. 1036. Robert Logan, Birkenside, Earlston, "Davie."

CLASS 122. SOW.—Premiums, £4 and £2.

1st. No. 1040. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Rose" (2682).
2d. No. 1038. The Earl of Haddington, Tyninghame, Prestonkirk, "Little Lady."
C. No. 1039. Robert Logan, Birkenside, Earlston.

CLASS 123. Three PIGS, not above 8 months old.—Premiums, £4 and £2.

1st. No. 1043. Sanders Spencer, Holywell Manor, St Ives, Hunts.
2d. No. 1041. Somner Logan, Harrietfield, Kelso.

BLACK OR BERKSHIRE BREED.

CLASS 124. BOAR.—Premiums, £4 and £2.

1st. No. 1044. W. Campbell, 191 Perth Road, Dundee.
2d. No. 1046. Captain Clayhills Henderson, R.N., Invergowrie, Dundee.
H.C. No. 1047. Captain Clayhills Henderson, R.N., Invergowrie, Dundee.

CLASS 125. SOW.—Premiums, £4 and £2.

1st. No. 1050. W. Campbell, 191 Perth Road, Dundee.
2d. No. 1048. W. Campbell, 191 Perth Road, Dundee.
H.C. No. 1049. W. Campbell, 191 Perth Road, Dundee.
C. No. 1051. Captain Clayhills Henderson, R.N., Invergowrie, Dundee.

CLASS 126. Three PIGS, not above 8 months old.—Premiums, £4 and £2.

1st. No. 1053. W. Campbell, 191 Perth Road, Dundee.
2d. No. 1054. W. Campbell, 191 Perth Road, Dundee.

POULTRY

First Premium—*One Sovereign.* Second Premium—*Ten Shillings*—In all Sections.

CLASS 1. DORKING, Silver Grey. Cock.

1st. No. 1. Bisset & Laing, Burnside, Auchtermuchty.
2d. No. 6. W. Moore, Greenhall, High Blantyre.
C. No. 2. James Cranston, Nunwood, Dumfries.

CLASS 2. DORKING, Silver Grey. Hen.

1st. No. 9. James Clunas, 76 High Street, Elgin.
2d. No. 8. James Clunas, 76 High Street, Elgin
C. No. 7. Bisset & Laing, Burnside, Auchtermuchty.

CLASS 3. DORKING, Silver Grey. Cockerel.

1st. No. 13. William Johnston, Hatton Fintray, Aberdeen.
2d. No. 14. A. M'Rea, Nine-Mile Burn, Penicuik.
C. No. 16. Lady Wilson, Chillingham Barns, Belford, Northumberland.

CLASS 4. DORKING, Silver Grey. Pullet.

1st. No. 18. James Cranston, Nunwood, Dumfries.
2d. No. 24. Lady Wilson, Chillingham Barns, Belford, Northumberland.
C. No. 21. William Johnston, Hatton Fintray, Aberdeen.

CLASS 5. DORKING, Coloured. Cock.

1st. No. 26. James Cranston, Nunwood, Dumfries.
2d. No. 31. Leonard Pilkington, Cavens, by Dumfries.
C. No. 27. Andrew Crichton, Estates Office, Glamis.

CLASS 6. DORKING, Coloured. Hen.

1st. No. 34. John Gillies, Edington Mills, Chirnside.
2d. No. 32. James Cranston, Nunwood, Dumfries.
C. No. 35. Leonard Pilkington, Cavens, by Dumfries.

CLASS 7. DORKING, Coloured. Cockerel

1st. No. 38. James Cranston, Nunwood, Dumfries.
2d. No. 39. Andrew Crichton, Glamis.
C. No. 36. William Adam, Tynet Lodge, Port Gordon.

CLASS 8. DORKING, Coloured. Pullet.

1st. No. 43. James T. Cathcart, Pitcairlie, Newburgh, Fife.
2d. No. 45. Andrew Crichton, Glamis.
C. No. 44. James Cranston, Nunwood, Dumfries.

CLASS 9. COCHIN-CHINA. Cock.

1st. No. 50. William Holmes, Hairlaws, Bridge of Weir.
2d. No. 51. John Lindsay, Leven Road, Windygates, Fife.
C. No. 48. The Countess of Aberdeen, Haddo House, Aberdeen.

CLASS 10. COCHIN-CHINA. Hen.

1st. No. 56. William Holmes, Hairlaws, Bridge of Weir.
2d. No. 59. Mrs G. Ramsden, The Parsonage, Glamis.
C. No. 57. James Logan, East Linton, Prestonkirk.

CLASS 11. COCHIN-CHINA. Cockerel—*Entries not forward.*

CLASS 12. COCHIN-CHINA. Pullet—*No Entry.*

CLASS 13. BRAHMAPOOTRA. Cock.

1st. No. 67. John Gillies, Edington Mills, Chirnside.
2d. No. 66. John Gillies, Edington Mills, Chirnside.
C. No. 72. James Lorimer, Sandridge Cottage, Monifieth.

CLASS 14. BRAHMAPOOTRA. Hen.

1st. No. 76. James Trotter, Stenton, Prestonkirk.
2d. No. 73. The Countess of Aberdeen, Haddo House, Aberdeen.
C. No. 75. James Lorimer, Sandridge Cottage, Monifieth.

CLASS 15. BRAHMAPOOTRA. Cockerel.

1st. No. 79. Mrs James Lorimer, 24 Whitehall Street, Dundee.
2d. No. 80. James Lorimer, Sandridge Cottage, Monifieth.

CLASS 16. BRAHMAPOOTRA. Pullet.

1st. No. 81. William Bruce, Binrock, Dundee.
2d. No. 82. James Lorimer, Sandridge Cottage, Monifieth.

CLASS 17. SCOTCH GREY. Cock.

1st. No. 88. John Robertson, Schawpark, Alloa.
2d. No. 85. William M'Kinnon, Stenhousemuir, by Larbert.
C. No. 83. A. W. Henderson, Airthrey Mills, Bridge of Allan.

CLASS 18. SCOTCH GREY. Hen.

1st. No. 89. James Greenshields, West Town, Lesmahagow.
2d. No. 90. A. W. Henderson, Airthrey Mills, Bridge of Allan.
C. No. 93. Miss Plumber, Airth Castle, Larbert.

CLASS 19. SCOTCH GREY. Cockerel.

1st. No. 95. James Greenshields, West Town, Lesmahagow.
2d. No. 96. David Hastings, Glaister Cottage, Darvel, Ayrshire.
C. No. 97. A. W. Henderson, Airthrey Mills, Bridge of Allan.

CLASS 20. SCOTCH GREY. Pullet.

1st. No. 104. David Hastings, Glaister Cottage, Darvel, Ayrshire.
2d. No. 102. James Greenshields, West Town, Lesmahagow.
C. No. 103. James Greenshields, West Town, Lesmahagow.

CLASS 21. HAMBURG. Cock.

1st. No. 110. James Huntly, Edington Mill, Chirnside.
2d. No. 108. A. Carnduff, Barrhead.
C. No. 107. Hugh Arndle, Stonefield, Paisley.

CLASS 22. HAMBURG. Hen.

1st. No. 113. Hugh Arndle, Stonefield, Paisley.
2d. No. 115. James Huntly, Edington Mill, Chirnside.
C. No. 114. A. Carnduff, Barrhead.

CLASS 23. HAMBURG. Cockerel.

1st. No. 119. James Huntly, Edington Mill, Chirnside.
2d. No. 118. A. Carnduff, Barrhead.
C. No. 121. D. L. Picken, Milton Farm, Kirkcudbright.

CLASS 24. HAMBURG. Pullet.

1st. No. 122. James Huntly, Edington Mill, Chirnside.
2d. No. 124. Dr Richmond, 57 Love Street, Paisley.
C. No. 125. William Watson, Arns Farm, Clackmannan.

CLASS 25. PLYMOUTH ROCK. Cock.

1st. No. 128. Leonard Pilkington, Cavens, by Dumfries.
2d. No. 129. Leonard Pilkington, Cavens, by Dumfries.
C. No. 126. The Countess of Aberdeen, Haddo House, Aberdeen.

CLASS 26.. PLYMOUTH ROCK. Hen.

1st. No. 133. Leonard Pilkington, Cavens, by Dumfries.
2d. No. 131. The Countess of Aberdeen, Haddo House, Aberdeen.
C. No. 132. Rev. Fitzroy Lloyd, The Priory, Pittenweem, Fife.

CLASS 27. PLYMOUTH ROCK. Cockerel.

1st. No. 138. Rev. Fitzroy Lloyd, The Priory, Pittenweem, Fife.
2d. No. 140. L. H. & J. Nutter, Croft House, Burton, Westmoreland.

CLASS 28. PLYMOUTH ROCK. Pullet.

1st. No. 143. Rev. Fitzroy Lloyd, The Priory, Pittenweem, Fife.
2d. No. 145. L. H. & J. Nutter, Croft House, Burton, Westmoreland.
C. No. 141. The Countess of Aberdeen, Haddo House, Aberdeen.

CLASS 29. MINORCA. Cock.

1st. No. 146. William Hendry, Sorn, by Mauchline.
2d. No. 148. Peter Milne, Inspector of Poor, Lasswade.

CLASS 30. MINORCA. Hen.

1st. No. 154. Neil Munro, Elmbank, Oban.
2d. No. 150. Robert Hay, Holmhead, Rutherglen.
C. No. 152. Mrs D. Mackenzie, Post Office, Meigle.

CLASS 31. MINORCA. Cockerel.

1st. No. 157. Robert Craig, Main Street, West Kilbride.
2d. No. 163. Smith & Waugh, Dundas, South Queensferry.
C. No. 160. Mrs Kinnaird, Clockmill, Duns.

CLASS 32. MINORCA. Pullet.

1st. No. 170. David Marr, Schoolhouse, Maryton, Montrose.
2d. No. 172. Smith & Waugh, Dundas, South Queensferry.
C. No. 165. A. Cooper, Kirkbean, by Dumfries.

CLASS 33. LEGHORN. Cock.

1st. No. 174. John Devlin, Poorhouse, Dunfermline.
2d. No. 175. Peter Lithgow, Drumtall, East Kilbride.

CLASS 34. LEGHORN. Hen.

1st. No. 178. John Devlin, Poorhouse, Dunfermline.
2d. No. 180. George A. Hunter, Galabrig, Galashiels.
C. No. 181. William Keys, Kintore, Aberdeenshire.

CLASS 35. LEGHORN. Cockerel.

1st. No. 184. W. L. Cowell, Dunipace House, Larbert.
2d. No. 187. William Jamieson, 50 David's Loan, Bainsford, Falkirk.
C. No. 185. Edith M. Devlin, Cemetery Road, Dunfermline.

CLASS 36. LEGHORN. Pullet.

1st. No. 199. Mrs W. Jamieson, 50 David's Loan, Bainsford, Falkirk.
2d. No. 197. Edith M. Devlin, Cemetery Road, Dunfermline.
C. No. 200. William Keys, Kintore, Aberdeenshire.

CLASS 37. LANGSHAN. Cock.

1st. No. 206. John S. Pagan, Coulshill, Auchterarder.
2d. No. 207. Thomas Scott, South Woodend, Bonnybridge.
C. No. 204. Mrs Francis Joynson, Wyseby, Ecclefechan, N.B.

CLASS 38. LANGSHAN. Hen.

1st. No. 211. Thomas Scott, South Woodend, Bonnybridge.
2d. No. 210. John S. Pagan, Coulshill, Auchterarder.
C. No. 208. Mrs Francis Joynson, Wyseby, Ecclefechan, N.B.

CLASS 39. LANGSHAN. Cockerel.

1st. No. 212. Mrs Francis Joynson, Wyseby, Ecclefechan, N.B.
2d. No. 213. John S. Pagan, Coulshill, Auchterarder.

CLASS 40. LANGSHAN. Pullet.

1st. No. 214. Mrs Francis Joynson, Wyseby, Ecclefechan, N.B.
2d. No. 215. John S. Pagan, Coulshill, Auchterarder.

CLASS 41. WYANDOTTE. Cock.

2d. No. 217. Henry Maidment, Lanercost, Brampton, Cumberland.

CLASS 42. WYANDOTTE. Hen.

1st. No. 218. Mrs R. Gilfillan, Townhill, Dunfermline.
2d. No. 219. Henry Maidment, Lanercost, Brampton, Cumberland.

CLASS 43. WYANDOTTE. Cockerel.

1st. No. 221. Henry Maidment, Lanercost, Brampton, Cumberland.
2d. No. 220. Mrs Kinnaird, Clockmill, Duns.

CLASS 44. WYANDOTTE. Pullet.

1st. No. 225. Henry Maidment, Lanercost, Brampton, Cumberland.
2d. No. 224. Mrs Kinnaird, Clockmill, Duns.
C. No. 226. James Thomson, Galadean, Hawthornden, Lasswade.

CLASS 45. Any other Pure Breed. Cock.

1st. No. 231. James Trotter, Stenton, Prestonkirk (White-crested Poland).
2d. No. 230. Dr Richmond, 57 Love Street, Paisley.
C. No. 229. David Marr, Schoolhouse, Maryton, Montrose (Poland).

CLASS 46. Any other Pure Breed. Hen.

1st. No. 234. Mrs D. Mackenzie, Post Office, Meigle.
2d. No. 236. Dr Richmond, 57 Love Street, Paisley.
C. No. 232. The Countess of Aberdeen, Haddo House, Aberdeen (Indian Game).

CLASS 47. Any other Pure Breed. Cockerel.

1st. No. 239. Mrs D. Mackenzie, Post Office, Meigle.
2d. No. 240. Dr Richmond, 57 Love Street, Paisley.

CLASS 48. Any other Pure Breed. Pullet.

2d. No. 242. Sommer Logan, Kelso (Orpington).

CLASS 49. GAME—Black or Brown Reds. Cock.

1st. No. 244. J. A. Mather, Grovehill Stud Farm, Thornhill.
2d. No. 246. Leonard Pilkington, Cavens, by Dumfries.

CLASS 50. GAME—Black or Brown Reds. Hen.

1st. No. 247. J. A. Mather, Grovehill Stud Farm, Thornhill.
2d. No. 248. Dr Orr, Westfield, Johnstone.
C. No. 249. Leonard Pilkington, Cavens, by Dumfries.

CLASS 51. GAME—Black or Brown Reds. Cockerel.

1st. No. 250. J. A. Mather, Grovehill Stud Farm, Thornhill.
2d. No. 251. John Sneddon, Beechbank, Ratho.

CLASS 52. GAME—Black or Brown Reds. Pullet.

1st. No. 253. John Sneddon, Beechbank, Ratho.
2d. No. 252. John Fisher, Heartstone Hill, New Mains.

CLASS 53. GAME—Any other Pure Breed. Cock.

1st. No. 254. J. A. Mather, Grovehill Stud Farm, Thornhill.
2d. No. 255. John Sneddon, Beechbank, Ratho (Duckwing).

CLASS 54. GAME—Any other Pure Breed. Hen.

1st. No. 257. John Sneddon, Beechbank, Ratho (Duckwing).
2d. No. 256. Pratt, Duncan, & Pratt, Falkland.

CLASS 55. GAME—Any other Pure Breed. Cockerel.

1st. No. 259. John Sneddon, Beechbank, Ratho (Duckwing).
2d. No. 258. Dr Orr, Westfield, Johnstone.

CLASS 56. GAME—Any other Pure Breed. Pullet.

1st. No. 260. Dr Orr, Westfield, Johnstone.
2d. No. 261. John Sneddon, Beechbank, Ratho (Duckwing).

CLASS 57. BANTAM—Any Pure Breed. Cock.

1st. No. 265. Thomas Guild, Herdhill, Kirriemuir (Game).
2d. No. 263. A. Cooper, Kirkbean, by Dumfries (Game).
C. No. 267. Hynd Bros., 27 Parkneuk, Dunfermline.

CLASS 58. BANTAM—Any Pure Breed. Hen.

1st. No. 272. Thos. Guild, Herdhill, Kirriemuir (Game).
2d. No. 269. A. Cooper, Kirkbean, by Dumfries.
C. No. 270. Miss Frew, Barony House, Cupar-Fife.

CLASS 59. BANTAM—Any Pure Breed. Cockerel.

1st. No. 278. Thomas Guild, Herdhill, Kirriemuir.
2d. No. 279. William Hynd, 196 Baldridgeburn, Dunfermline.
C. No. 281. John Sneddon, Beechbank, Ratho.

CLASS 60. BANTAM—Any Pure Breed. Pullet.

1st. No. 283. James Duncan, 7 Bell Place, Forfar.
2d. No. 288. William Hynd, 196 Baldridgeburn, Dunfermline.
C. No. 286. Thomas Guild, Herdhill, Kirriemuir.

CLASS 61. DUCKS—White Aylesbury. Drake.

1st. No. 290. John Gillies, Edington Mills, Chirnside.
2d. No. 292. John S. Pagan, Coulshill, Auchterarder.
C. No. 293. Thomas Scott, South Woodend, Bonnybridge.

CLASS 62. DUCKS—White Aylesbury. Duck.

1st. No. 294. Miss Blackburn, Killearn, Glasgow.
2d. No. 295. John Gillies, Edington Mills, Chirnside.

CLASS 63. DUCKS—White Aylesbury. Drake (Young).

1st. No. 298. Miss Blackburn, Killearn, Glasgow.
2d. No. 301. John S. Pagan, Coulshill, Auchterarder.
C. No. 302. Thomas Scott, South Woodend, Bonnybridge.

CLASS 64. DUCKS—White Aylesbury. Duckling.

1st. No. 305. John S. Pagan, Coulshill, Auchterarder.
2d. No. 306. Thomas Scott, South Woodend, Bonnybridge

CLASS 65. DUCKS—Rouen. Drake.

1st. No. 308. D. L. Picken, Milton Farm, Kirkcudbright.
2d. No. 309. Thomas Scott, South Woodend, Bonnybridge.

CLASS 66. DUCKS—Rouen. Duck.

1st. No. 311. D. L. Picken, Milton Farm, Kirkcudbright.
2d. No. 310. John M. Martin, of Auchendennan, Alexandria.

CLASS 67. DUCKS—Rouen. Drake (Young)

1st. No. 314. Thomas Scott, South Woodend, Bonnybridge.
2d. No. 315. Lady Wilson, Chillingham Barns, Belford, Northumberland.

CLASS 68. DUCKS—Rouen. Duckling.

1st. No. 317. Thomas Scott, South Woodend, Bonnybridge.
2d. No. 316. D. L. Picken, Milton Farm, Kirkcudbright.

CLASS 69. DUCKS—Any other Pure Breed. Drake.

1st. No. 319. Somner Logan, Kelso (Pekin).
2d. No. 321. Lady Wilson, Chillingham Barns, Belford, Northumberland (Cayuga).

CLASS 70. DUCKS—Any other Pure Breed. Duck.

1st. No. 322. Somner Logan, Kelso (Pekin).
2d. No. 326. Lady Wilson, Chillingham Barns, Belford, Northumberland (Cayuga).
C. No. 324. Alexander Watt, 4 Home Park, Aberdour, Fife (Cayuga).

CLASS 71. DUCKS—Any other Pure Breed. Drake (Young).

1st. No. 327. E. H. Graham Stirling, Strowan, Crieff (Pekin).
2d. No. 328. Lady Wilson, Chillingham Barns, Belford, Northumberland (Cayuga).

CLASS 72. DUCKS—Any other Pure Breed. Duckling.

1st. No. 329. E. H. Graham Stirling, Strowan, Crieff (Pekin).
2d. No. 330. Lady Wilson, Chillingham Barns, Belford, Northumberland (Cayuga).

CLASS 73. TURKEYS—Any Pure Breed. Cock.

1st. No. 337. Lady Wilson, Chillingham Barns, Belford, Northumberland.
2d. No. 332. Mrs J. M. Caverhill, Hillend, Reston (American Bronze).
C. No. 333. Robert Clark, Taybank, Errol (American Bronze).

CLASS 74. TURKEYS—Any Pure Breed. Hen.

1st. No. 339. Thomas Scott, South Woodend, Bonnybridge.
2d. No. 342. Lady Wilson, Chillingham Barns, Belford, Northumberland.
C. No. 338. Miss Blackburn, Killearn, Glasgow (Bronze).

CLASS 75. TURKEYS—Any Pure Breed. Cock (Poult).

1st. No. 343. George A. Bell, Downfield, Ladybank (American Bronze).
2d. No. 344. Abram Kerr, Castlehill, Thornhill, Dumfriesshire (Bronze).

CLASS 76. TURKEYS—Any Pure Breed. Hen (Poult).

1st. No. 347. Abram Kerr, Castlehill, Thornhill, Dumfriesshire (Bronze).
2d. No. 346. George A. Bell, Downfield, Ladybank (American Bronze

CLASS 77. GEESE—Any Pure Breed. Gander.

1st. No. 351. D. L. Picken, Milton Farm, Kirkcudbright.
2d. No. 350. John M. Martin, of Auchendennan, Alexandria, N.B.

CLASS 78. GEESE—Any Pure Breed. Goose.

1st. No. 353. James Dow, Clathybeg, Auchterarder (Ebden).
2d. No. 354. John M. Martin, of Auchendennan, Alexandria, N.B.
C. No. 355. D. L. Picken, Milton Farm, Kirkcudbright.

CLASS 79. GEESE—Any Pure Breed. Gander (Young).

1st. No. 357. D. L. Picken, Milton Farm, Kirkcudbright.
2d. No. 358. Thomas Scott, South Woodend, Bonnybridge.

CLASS 80. GEESE—Any Pure Breed. Gosling.

1st. No. 360. Thomas Scott, South Woodend, Bonnybridge.
2d. No. 359. D. L. Picken, Milton Farm, Kirkcudbright.

DAIRY PRODUCE

CLASS 1. CURED BUTTER, not less than 28 lb.—Premiums, £4, £2, and £1.

1st. No. 7. David Longwall, Kendieshill, Linlithgow.
2d. No. 9. Henry Orr, Torrance, West Craigs.
3d. No. 3. Mrs Cullen, Woodend, Airdrie.
H.C. No. 4. Alexander Fleming, Threepland, Eaglesham.
C. No. 10. Thomas Orr, Croftmalloch, Whitburn.

CLASS 2. POWDERED BUTTER, not less than 7 lb.—Premiums, £4, £2, and £1.

1st. No. 14. Alexander Clarkson & Sons, Cormiston, Biggar.
2d. No. 16. Mrs Cullen, Woodend, Airdrie.
3d. No. 27. Henry Orr, Torrance, West Craigs.
H.C. No. 20. Robert Gilmour, Stonebyres, Eaglesham.
C. No. 24. John Mitchell, Wester Bogie, Kirkcaldy.

CLASS 3. FRESH BUTTER, Three 1-lb. Rolls.—Premiums, £4, £2, and £1.

1st. No. 36. Mrs Cullen, Woodend, Airdrie.
2d. No. 34. Alexander Clarkson & Sons, Corniston, Biggar.
3d. No. 47. Thomas Nimmo, Lawhead, Forth, Lanark.
H.C. No. 44. David Longwall, Kendieshill, Linlithgow.
C. No. 38. William Duncan, Middlerigg, Polmont Station.

CLASS 4. CHEDDAR CHEESE, 56 lb. and upwards.—Premiums, £6, £4, £2, and £1.

1st. No. 60. Alexander Cross, Knockdon, Maybole.
2d. No. 72. Henry M'Fadzean, Ashfield, Maybole.
3d. No. 70. John M'Camon, Kirranrae, Stranraer.
4th. No. 73. Robert M'Kerrow, Milton, Kirkcudbright.
H.C. No. 78. John Smith, Auchlane, Castle-Douglas.
C. No. 61. William Devlin, Boreland, Balmaghie, Castle-Douglas.

CLASS 5. SWEET-MILK CHEESE, under 56 lb.—Premiums, £4, £2, and £1.

1st. No. 85. Robert Montgomerie, Lessnessock, Ochiltree.
2d. No. 84. William M'Master, Challoch, Dunragit.
3d. No. 88. Sir Mark J. Stewart, M.P., Southwick, Dumfries.
H.C. No. 79. John H. Barrowman, Caigton, Castle-Douglas.

HIGHLAND INDUSTRIES

CLASS 1. Two PLAIDS, Native Wool, hand-spun, home-dyed, handloom-woven.—Premiums, £2 and £1.

1st. No. 1365. Mrs Morrison, Keanachulish, Ullapool.
2d. No. 1363. Mrs Kenneth Mackenzie, Badanscallie, Coigeach.

CLASS 2. WEB, not less than 25 yards TWEED, Cheviot Wool, hand-spun, home-dyed, and handloom-woven.—Premiums, £3 and £1.

1st. No. 1367. Mrs Donald Macleod, Old Dornie, Coigeach.
2d. No. 1368. Mrs Macleod, Lecklee, Tarbert.

CLASS 3. WEB, not less than 25 yards TWEED, Blackfaced Wool, hand-spun, home-dyed, and handloom-woven.—Premiums, £3 and £1.

1st. No. 1372. Mary M'Donald, Lochmaddy.
2d. No. 1373. Widow M'Innes, Rhenigudle, Harris.

CLASS 4. WEB, 25 yards TWEED, Light Texture, for Ladies' Dresses, Native Wool, hand-spun, home-dyed, and handloom-woven.—Premiums, £3 and £1.

1st. No. 1374. Mrs Morrison, Ardvee, Finsbay.

CLASS 5. WEB, not less than 16 yards of SHETLAND TWEED, of Shetland Wool, hand-spun, home-dyed, and handloom-woven.—Premiums, £2 and £1.

1st. No. 1379. Mrs Sutherland.
2d. No. 1382. Mr Williamson, Gravin, Delting.
V.H.C. No. 1380. Mrs Sutherland.

CLASS 6. Six pair STOCKING HOSE, hand-spun, home-dyed, and knitted by Exhibitor,—two pair Plain Ribbed, two pair Diced Tartan, two pair Fancy.—Premiums, £2 and £1.

1st. No. 1385. Ann Mackenzie, Port Henderson, Gairloch.
2d. No. 1384. Ann Macaulay, Opinan, Gairloch.

CLASS 7. Twelve pair SOCKS of Blackfaced Wool, hand-spun, home-dyed, and knitted by Exhibitor.—Premiums, £2 and £1.

1st. No. 1388. Ann Macdonald, 18 Sand, Gairloch.

CLASS 8. Twelve pair SOCKS of Cheviot Wool, hand-spun, home-dyed, and knitted by Exhibitor.—Premiums, £2 and £1.

1st. No. 1389. Ann Macaulay, Opinan, Gairloch.

CLASS 9. Fine White SHETLAND SHAWL.—Premiums, £3 and £1.

1st. No. 1397. Ann Nisbet, Unst.
2d. No. 1401. Mrs Sutherland, Gritquoy, Unst.
V.H.C. No. 1392. Jane Garioch.

CLASS 10. Thick Coloured SHETLAND SHAWL (Plain).—Premiums, £3 and £1.

1st. No. 1410. Helen Gifford, Island of Bressay.
2d. No. 1443. Catherine Robertson.

CLASS 10. Thick Coloured SHETLAND SHAWL (Shaded).—Premiums, £3 and £1.

1st. No. 1431. Mrs James Linklater, Hillhead, Lerwick.
2d. No. 1439. Miss Patrie.
V.H.C. No. 1425. Mary Johnson, West Quarff, Scalloway.

CLASS 11. Collection of not less than five Articles, of Native Wool, hand-spun, home-dyed, and knitted by Exhibitor.—Premiums, £2 and £1.

1st. No. 1455. M. Anderson.
2d. No. 1463. Mrs Malcolmson.

CLASS 12. Varieties of YARN, not less than eight Cuts, hand-spun, home-dyed, and of Native Wool; 4 cuts of each colour.—Premiums, £2 and £1.

1st. No. 1475. Mrs John Umphray, Island of Foula.
2d. No. 1472. Mrs Cram, Island of Roe.

CLASS 13. Working Model of Sea-fish Hatching Apparatus from floating ova.—Premiums, £2 and £1. (*No entry.*)

CLASS 14. Box for Carriage of Fresh Fish to Market.—Premiums, £2 and £1. (*No entry.*)

CLASS 15. Collection of Trout and Salmon Flies, home-made.—Premiums, £2 and £1. (*No award.*)

WEIGHBRIDGE COMPETITION

Henry Pooley & Son, Glasgow, ... £10 10 0

SCOTTISH BEEKEEPERS' ASSOCIATION

John M'Donald, Lynchat, Kingussie, for a Frame Hive suitable for Modern Bee-keeping made by an amateur not being a professional carpenter.—Silver Medal.
W. P. Meadows, Syston, Leicester, for two Super Clearing Boards.—Silver Medal.

BLOCK-TEST COMPETITION

Wednesday, 26th July.

James Paterson, Burnturk, Blairdrummond,	£3	0	0
John Edmond, Gallamuir, Bannockburn,	2	0	0
William Duncan, Welltown, Coupar-Angus,	1	0	0

Thursday, 27th July.

William Fettes, Corskie, Garmouth, Elgin,	3	0	0
Joseph Bowman, Lynehow, Carlisle,	2	0	0
Robert Gillies, Castlecarry, Bonnybridge,	1	0	0

COW-MILKING APPLIANCE

Struthers, Weir & Co., Carluke.—Medium Silver Medal.

TURNS-OUT

CLASS 63. Best TURN-OUT of SINGLE HORSE, HARNESS, and TRAP, to be driven in the ring, 15 hands and upwards.—Premiums, £8, £4, and £2.

1st. No. 619. Alexander Scott, Berry Yards Farm, Upper Greenock.
2d. No. 600. A. H. Boyle, Ruchill House, Maryhill.
3d. No. 613. Miss Houldsworth, of Coltness, Wishaw.

CLASS 64. Best TURN-OUT of SINGLE HORSE, HARNESS, and TRAP, to be driven in the ring, under 15 hands.—Premiums, £8, £4, and £2.

1st. No. 625. A. W. Hickling, Wollaton, Nottingham.
2d. No. 629. Charles W. Scott, Woodbank, Dumfries.
3d. No. 633. A. H. Boyle, Ruchill House, Maryhill.
V.H.C. No. 635. Andrew Hunter, Braehead House, Cathcart.
H.C. No. 677. James Blyth, Ord House, Berwick-on-Tweed.
C. No. 631. W. C. Weir, 10 Princes Terrace, Dowanhill, Glasgow.

JUMPING

Wednesday, 26th July.

CLASS 74. HORSES, Open.—Premiums, £20, £10, and £5.

1st. No. 19. James M. Bell, Carlisle, Horse, "Stranger."
2d. No. 18. M. Bell, Broats House, Annan, Mare, "Border Witch."
3d. No. 3. Master C. Curtis, 46 The Crescent, Goole, Yorkshire, Mare, "Busybody."
V.H.C. No. 11. David Sprott, Crown Inn, Alva, Gelding, "Weaver."

CLASS 75. PONIES, 14½ Hands and under.—Premiums, £5, £3, and £1.

1st. No. 3. Master C. Curtis, 46 The Crescent, Goole, Yorkshire, Mare, "Busybody."
2d. No. 7. William Connaly, Ballrigge, Castle-Douglas.
3d. No. 8. Colonel Hannay, The Castle, Edinburgh, Mare, "Infra" (2113).
V.H.C. No. 2. D. Carnegie, Colinsburgh, Gelding, "Bay-Lark."
H.C. No. 4. David Smallwood, Old Abbey Hotel, Whitby, Mare, "Milkmaid."

Thursday, 27th July.

CLASS 76. HORSES that have never won a £20 Prize for Jumping.—Premiums, £10, £6, and £3.

1st. No. 10. Robert A. King, Wester Fulwood, Johnstone, Gelding, "The Clown."
2d. No. 5. Hastie & Swinhoe, 5 Cross Street, Newcastle-on-Tyne, Gelding, "The Infant."
3d. No. 14. Master C. Curtis, 46 The Crescent, Goole, Yorkshire, Mare, "Busybody."
V.H.C. No. 11. M. Bell, Broats House, Annan, Mare, "Border Witch."

CLASS 77. PONIES, 14 Hands and under.—Premiums, £5, £3, and £1.

1st. No. 19. David Smallwood, Old Abbey Hotel, Whitby, Mare, "Milkmaid."
2d. }
3d. } *No award.*

Friday, 28th July.

CLASS 78. HORSES that have never won a £10 Prize for Jumping.—Premiums, £10, £6, and £3.

1st. No. 11. William Connaly, Bellrig, Castle-Douglas, "Drury Lane."
2d. No. 10. David Smallwood, Old Abbey Hotel, Whitby, Mare, "Milkmaid."
3d. No. 9. James Wilson, Brook Villa, Nantwich, Cheshire, Mare, "Tibbie Shiels."
H.C. No. 6. Hastie & Swinhoe, 5 Cross Street, Newcastle-on-Tyne, Gelding, "The Infant."
C. No. 5. H. J. Earnshaw, The Crescent, Goole, Yorkshire, Gelding, "Highflyer."

CLASS 79. PONIES, 13½ Hands or under.—Premiums, £3 and £1.

1st. No. 14. M. H. Tristram, Piershill Barracks, Mare, "Midget."
2d. No. 15. G. Hobson, Piershill Barracks, Mare, "Vixen."

JUDGES.

SHORTHORN.—L. C. Chrisp, Hawkhill, Alnwick; James Thomson, Balbegno, Fettercairn.

ABERDEEN-ANGUS.—George J. Walker, Portlethen, Aberdeen; W. S. Ferguson, Pictstonhill, Perth.

GALLOWAY.—R. F. Dudgeon, The Grange, Kirkcudbright; John Thomson, Laggan, Gatehouse.

HIGHLAND.—Hugh Macdiarmid, Island House, Tiree.

AYRSHIRE.—J. Cochrane, Nether Craig, Kilmarnock; John Fleming, Meadowbank, Strathaven.

JERSEY.—F. A. Hordern, Roodlands, Edenbridge, Kent.

STALLIONS AND ENTIRE COLTS.—David Buchanan, Garscadden Mains, New Kilpatrick; Robert Stevenson, Hayston, Kirkintilloch.

MARES AND FILLIES.—Robert M'Alister, Mid Ascog, Rothesay; James Weir, Sandilands, Lanark.

HUNTERS AND ROADSTERS.—T. H. Hutchinson, Manor House, Catterick.

HACKNEYS.—John Major, Sleamere Grange, Yorks.

PONIES.—A. Johnstone Douglas, Comlongan Castle, Ruthwell, R.S.O.

BLACKFACED.—Peter M'Intyre, Tigh-na-blair, Comrie; James Moffat, Gateside, Sanquhar.

CHEVIOT.—John Murray, Parkhall, Douglas.

BORDER LEICESTER.—Matthew Ridley, Peelwell, Haydon Bridge; Andrew Smith, Longniddry.

SHROPSHIRE AND OXFORD DOWNS.—A. E. Mansell, Harrington Hall, Shifnal.

HALF-BRED.—John Caverhill, Jedneuk, Jedburgh.

FAT SHEEP AND EXTRA STOCK.—James Swan, 47 Lauriston Place, Edinburgh.

SWINE.—James Barr, Royal Asylum, Gartnavel, Glasgow.

POULTRY.—J. Dixon, North Park, Clayton, Bradford.

DAIRY PRODUCE.—Hugh Fulton, 71 Brunswick Street, Glasgow.

HIGHLAND INDUSTRIES.—Mrs Campbell of Dunstaffnage; Mrs Athole M'Gregor, Dunkeld; and Miss Warrand, of Ryefield, Ross-shire.

WEIGHBRIDGES.—A. S. Logan, Ferney Castle, Reston; John Speir, Newton Farm, Newton; J. D. Park, engineer to the Society; William Shaw, inspector of weights and measures, Edinburgh.

ATTENDING MEMBERS.

SHORTHORN.—R. G. Wardlaw Ramsay, Whitehill; Charles Smith, Whittinghame; William Tod, Pardovan.

ABERDEEN-ANGUS.—A. M. Gordon of Newton; J. T. Mungle, West Calder; John Durie, Tranent.

GALLOWAY.—C. Macpherson Grant of Drumduan; John Edgar, Kirkettle; A. L. Drysdale, Dalmeny Park.

HIGHLAND.—Sir Robert Menzies, Bart.; James Wylie, Pathhead; Councillor Forbes Mackay.

AYRSHIRE.—John Speir, Newton Farm; George Dudgeon, Almondhill; Captain Wilkie of Ormiston.

JERSEY.—John Cran, Kirkton; Colonel Anderson of Bourhouse.

STALLIONS AND ENTIRE COLTS.—R. Sinclair Scott, Burnside; Capt. Clayhills Henderson of Invergowrie, R.N.; G. M. Falconer Stewart of Binny.

MARES AND FILLIES.—Donald Fisher, Jellyholm; Robert Paterson, Hill of Drip; John Dobbie, Campend; James Wylie, Edinburgh.

HUNTERS AND ROADSTERS.—R. Shirra Gibb, Boon; A. P. Cross, Craigie Hall; W. W. Anderson of Kingston.

HACKNEYS.—William Ford, Fentonbarns; James Lesslie, Boghall; Captain Steuart of Westwood.

PONIES.—Gideon Pott of Dod; Thomas M. Skirving, Niddrie Mains; William Skinner, Town Clerk.

BLACKFACED.—W. H. Lumsden of Balmedie; David Pringle, Mitchelton; J. A. Maconochie Wellwood, Meadowbank.

CHEVIOT.—George Dun, Easter Kincaple.

BORDER LEICESTER.—John M. Aitken, Norwood; Alex. Dudgeon, Humbie.

SHROPSHIRE AND OXFORD DOWNS.—John Scott Dudgeon, Longnewton; Colonel Aitchison of Drumore.

HALF-BREDS.—John Ballingall, Dunbog; Captain Dundas, younger of Arniston.

FAT SHEEP.—Charles Howatson of Dornel, Glenbuck.

SWINE.—Colonel Stirling, Kippendavie; J. Fletcher of Salton.

POULTRY.—James Russel, Dundas Castle.

DAIRY PRODUCE.—Alexander Glendinning, New Mains; George Wilken, Waterside of Forbes, Alford, N.B.

JUMPING.—Sir James H. Gibson-Craig, Bart.; John Gilmour of Montrave; A. Alexander, Edinburgh; A. Anderson of Kingston; James Lesslie, Boghall; A. P. Cross, Craigie Hall.

HIGHLAND INDUSTRIES.—Duncan Forbes of Culloden; Sir Robert Menzies, Bart.

II.—REPORTS.

1. John Hart, Cowie, Stonehaven, for a Report on Dairy Management .	£10	0	0
2. A. C. Forbes, Bowood, Calne, Hants, for a Report on Preservation of Soil Fertility in Plantations	5	0	0
	£15	0	0

III.—DISTRICT COMPETITIONS.

CATTLE, HORSES, AND SHEEP.

NAME OF DIST.	PREMIUM AWARDED TO	FOR	AMOUNT.		
Wester Ross	J. Huntly Macdonald, Charlston	Clydesdale Filly	£2	0	0
	W. Peterkin, Dunglass	Shorthorn Heifer	2	0	0
	Walter Arras, Foddorty	Polled Bull	2	0	0
	M. Macrae, Kinbeachie	Highland Cow	2	0	0
	P. B. M'Intyre, Findon	Leicester Tup	1	0	0
	M. Macrae, Kinbeachie	Cheviot Tup	1	0	0
	Jas. A. Gordon of Arabella	Blackfaced Ewe	1	0	0
Lammermoor	William Elliot, Ellenford	Half-bred Ewes	1	0	0
	Messrs Elliot, Harehead	do. Gimmers . . .	1	0	0
	J. J. Rankin, Barnside	do. Lambs . . .	1	0	0
	John Robson, Milknowe	Cheviot Ewes	1	0	0
	H. H. Craw, Rawburn	do. Gimmers . . .	1	0	0
	J. F. Bayley, Halls	do. Ewe Lambs . . .	1	0	0
		Carry forward .	£17	0	0

NAME OF DIST.	PREMIUM AWARDED TO	FOR	AMOUNT.		
		Brought forward	£17	0	0
Lammermoor —contd.	David Elliot, Grueldykes	Clydesdale Filly	1	0	0
	Wm. Elliot, Raecleughhead	do.	1	0	0
	J. J. Rankin, Barnside	do.	1	0	0
	Lady John Scott, Flass	Blackfaced Ewes	1	0	0
	Lady John Scott, Flass	do. Gimmers	1	0	0
	Lady John Scott, Flass	do. Ewe Lambs	1	0	0
Spey, Aven, and Fid-dochside	Jas. M'William, Stoneytown	Shorthorn Heifer	2	0	0
	Jas. M'William, Stoneytown	do.	1	0	0
	Colonel Grant, Auchorichan	Aberdeen-Angus Cow	2	0	0
	John R. Findlay of Aberlour	do. Heifer	1	0	0
	Trustees of Cragganmore	Clydesdale Filly	2	0	0
	Trustees of Cragganmore	do.	1	0	0
	John Black, Dufftown	Blackfaced Gimmers	1	0	0
	James Shiach, Wardhead	do.	0	10	0
	James Sutor, Collie	Leicester Gimmers	1	0	0
	Jas. M'William, Stoneytown	do.	0	10	0
Jed-Forest	John Elliot, West Middles	Clydesdale Mare	2	0	0
	Daniel Kennedy, Little-deanlees	do.	1	0	0
	J. A. W. Mein of Hunthill	Shorthorn Cow	2	0	0
	Earl of Minto, Minto House	do.	1	0	0
	Somner Logan, Harrietfield	Half-bred Shearling Tup	3	0	0
	George Douglas, Upper Hindhope	Cheviot Sheep	3	0	0
Central Banffshire	Robert Turner, Cairnton	Shorthorn Bull	1	10	0
	Jas. M'William, Stoneytown	do. Cow	1	10	0
	John Grant, Advie Mains	Aberdeen-Angus Bull	1	10	0
	John Grant, Advie Mains	do. Cow	1	10	0
	Alexander Simpson, Kirkside	Clydesdale Mare	1	10	0
	Countess of Seafield, Cullen	do. Filly	1	10	0
	Jas. M'William, Stoneytown	Pen of Leicester Sheep	1	0	0
	Geo. Cruickshank, Netherton	Pen of Blackfaced Sheep	1	0	0
	Geo. Cruickshank, Netherton	Pen of Cheviot Sheep	1	0	0
Strathspey	John M'Intyre, Ballintomb	Draught Mare	2	10	0
	Major Cumming, Curr	Highland Pony	2	10	0
	John Grant, Advie Mains	Aberdeen-Angus Bull	2	10	0
	John Grant, Advie Mains	do. Cow	2	10	0
	Jno. M. Allan, Duthil	Blackfaced Tup	2	0	0
West Linton	W. Connel Black, Kailzie	Cheviot Aged Tup	2	0	0
	C. A. Gracie, E. Happrew	do.	1	0	0
	Wm. Watson, Whitfield	Cheviot Shearling Tup	2	0	0
	Wm. Watson, Whitfield	do.	1	0	0
	John Elliot, Meigle	Cheviot Ewes	2	0	0
	John Elliot, Meigle	do.	1	0	0
	John Elliot, Meigle	Cheviot Gimmers	2	0	0
	W. Connel Black, Kailzie	do.	1	0	0
Islay, Jura, and Colon-say	J. & G. Weir, Ballymartin	Highland Bull	1	0	0
	James M'Kinlay, Lagavullin	do.	0	15	0
	R. & J. Campbell, Kintra	Highland Cow	1	0	0
	R. & J. Campbell, Kintra	Highland Heifer	1	0	0
	John Thomson, Bruich-laddich	Ayrshire Bull	1	0	0
	W. & W. H. Weir, Daill	do.	1	0	0
	Wm. Kerr, Corrary	do. Cow	1	0	0
	John Dunlop, Laggan	do.	1	0	0
	John Carmichael, Knockdon	Clydesdale Mare and Foal	1	0	0
	J. M. & H. Gillespie, Craigens	do. Yeld Mare	1	0	0
	A. S. & J. Clark, Sunderland	Roadster	1	0	0
	A. S. & J. Clark, Sunderland	do.	1	0	0
		Carry forward	£94	15	0

NAME OF DIST.	PREMIUM AWARDED TO	FOR	AMOUNT.		
		Brought forward	£94	15	0
West Teviot-dale	James Moffat, Craik	Cheviot Tup	2	0	0
	Miss Marion Grieve, Skelf-hill	do.	1	0	0
	James Moffat, Craik	Cheviot Shearling Tup	2	0	0
	James Moffat, Craik	do.	1	0	0
	T. O. Thornton, Hyndlee	Cheviot Ewes	2	0	0
	Walter Elliot, Hollybush	do.	1	0	0
	James Elliot, Burnhead	Cheviot Gimmers	2	0	0
	W. & J. Paterson, Wauchope	do.	1	0	0
Kincardine-shire	James Milne, jun., Cairnhill	Shorthorn Bull	Minor Silver Medal		
	John Smith, Balmain	Shorthorn Cow	Minor Silver Medal		
	James Alexander, Bent	Draught Mare	Minor Silver Medal		
Elgin and Northern District	Alexander Scott, Greenock	Stallion	15	0	0
Lanark, &c.	William Montgomery, Banks	Stallion	15	0	0
Nairnshire	Earl Cawdor, Cawdor Castle	Stallion	15	0	0
Inverness	D. Riddell, Blackhall	Stallion	15	0	0
Speyside	P. & W. Crawford, Dumfries	Stallion	15	0	0
Lower Ward of Renfrewshire	R. Sinclair Scott, Burnside	Stallion	15	0	0
			£196	15	0
		3 Minor Silver Medals	0	16	0
			£197	11	0

SPECIAL GRANTS.

Ayrshire Agricultural Association	Vote to Dairy Produce Show at Kilmarnock	£20	0	0
Shetland Agricultural Society	Vote in aid of Premiums	5	0	0
Orkney Agricultural Society	do. do.	3	0	0
Orkney Horse-Breeding Society	do. do.	3	0	0
South Uist and Barra	do. do.	3	0	0
North Uist	do. do.	3	0	0
		£37	0	0

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

Minor Silver Medals were awarded to the following :—

ABERDEENSHIRE.

NAME OF DIST.	SILVER MEDAL AWARDED TO	FOR
Aberdour	Charles A. Barclay, Aberdour House	Shorthorn Bull
	James Milne, Pittendrum	Clydesdale Filly
Ebrieside	John Will, Quilquox	Clydesdale Mare
	John Grant, Methlick	Aberdeen-Angus Cow
Inverurie	William Charles, Gammons	Cross Cow
	George Bean, Balquhain Mains	Clydesdale Mare and Foal

NAME OF DIST.	SILVER MEDAL AWARDED TO	FOR
Kennethmont	Major Gordon, Culdrain	Clydesdale Filly
	Colonel Leith Hay, Leithhall	Shorthorn Bull
North of Scotland Bee Society	William Ross, Aberdeen	Display of Honey
	Cardno & Darling, Aberdeen	Hives and Bee Furniture
	Argyllshire.	
Ardnamurchan, Moidart, and Salen	Langal Crofters	Highland Bull
	Robert D. Colthart, Achatony	Blackfaced Sheep
Nether Lorn	John S. Blair, Melfort	Highland Cow
	Duncan M'Cowan, Oban Seil	Ayrshire Cow
	Ayrshire.	
Ardrossan	James Caldwell, Blackshaw	Ayrshire Cow
	William Stewart, Thirdparthall	Clydesdale filly
Beith	Patrick Coul, Wattieston	Ayrshire Cow
	John Crawford, jun., Manrahead	Clydesdale Stallion
Dundonald	John Caldwell, Bogside	Ayrshire Cow
	Hugh Todd, Harperland	Clydesdale Mare
Fenwick	Thomas L. Patrick, High Clunch	Clydesdale Mare
	D. W. Stewart, Walston	Ayrshire Bull
Kilbirnie	Patrick Coul, Wattiestone	Ayrshire Cow
	John Kerr, Newhouse	Clydesdale Mare
New Cumnock	William Wallace, Mauchline	Clydesdale Mare
	William Steele, Fardenreoch	Ayrshire Cow
	Dumfriesshire.	
Sanquhar	William Lorimer, The Rigg	Clydesdale Mare
	James Moffat, Gateside	Blackfaced Tup
	Elginshire.	
Forres and Northern Fat Cattle Club	Pat. Butler, Chapelton	Grain
	Mrs Sutor, The Collie	Poultry
	Inverness-shire.	
Glen Urquhart	Major W. Grant, Drumbuie	Sandy Oats
	Countess of Seafield, Balmacaan	Magnum Bonum Potatoes
North Uist	John Macdonald, Illeray	Highland Mare
	Allan Macdermid, Kylis	Highland Heifer
	Kirkcudbrightshire.	
Dalry	Miss M'Naught, Dalry	Poultry
	Miss Gibson, Scroggiehall	Butter
	Lanarkshire.	
Lanarkshire	Robert M'Kinlay, Hillhouse	Ayrshire Bull
	James Johnston, Lochburnie	Clydesdale Stallion
Shettleston and Chryston	John Anderson, Middlequarter	Ayrshire Cow
	R. & J. Findlay, Springhill	Clydesdale Stallion and Clydesdale Colt
Shotts, Calderwaterhead	Thomas Scott, Peathill	Ayrshire Cow
	David Adams, Draffan	Clydesdale Colt
	Perthshire.	
Moulin	Alexander Caddel, Cuilvonlin	Green Crop
	Roxburghshire.	
Roxburgh Bee-keepers' Association	Dr Fyfe, The Nest	Bee Furniture and Appliances
	Harry Wood, Paradise Apiaries	Clover Honey

45 Minor Silver Medals, £12.

PLOUGHING COMPETITIONS.

In 1892-93 the Society's Silver Medal was awarded at 173 Ploughing Competitions.
173 Minor Silver Medals, £46, 2s. 8d.

IV.—COTTAGES AND GARDENS.

Money Premiums	£6 0 0
25 Minor Silver Medals	6 13 4
Total	£12 13 4

V.—VETERINARY DEPARTMENT.

CLASS EXAMINATIONS—1893.

Silver Medals were awarded to the following:—

ROYAL (DICK) VETERINARY COLLEGE.

W. D. Rees	Chemistry	Peter Wilson	Cattle Pathology
W. S. Worthington	Junior Anatomy	Peter Wilson	Surgery & Obstetrics
W. E. Ison	Junior Anatomy	Jos. Harry	Materia Medica
W. S. Worthington	Botany	J. D. Stewart	Practical Pathology
J. W. M'Intosh	Vet. Med. & Hygiene		

NEW VETERINARY COLLEGE, EDINBURGH.

J. E. Mills	Botany	W. Jowett	Physiology
J. E. Mills	Chemistry	Geo. E. Gibson	Path. of the Horse
J. E. Hutchinson	Junior Anatomy	H. G. Bowes	Path. of the Ox, &c.
J. Spreull	Senior Anatomy	H. G. Bowes	Demonstrator of Morbid Anatomy

GLASGOW VETERINARY COLLEGE.

H. M'Connell	Horse Pathology	T. C. Ferguson	Physiology
P. J. Welch	Cattle Pathology	R. Miller	Junior Anatomy
J. Gorman	Senior Anatomy	M. E. White	Chemistry
R. Moore	Materia Medica	W. Roy	Botany

25 Large Silver Medals, £17, 10s.

VI.—AGRICULTURAL CLASS, EDINBURGH UNIVERSITY.

A. C. Welch, Rhymers Manse, Earlston	£4 0 0
Robert Affleck, Castle-Douglas	3 0 0
Herbert S. Daine, Woolfall, Huyton, Liverpool	3 0 0
	£10 0 0

ABSTRACT OF PREMIUMS.

1. Essays and Reports		£15 0 0
2. Edinburgh Show		2329 9 11
3. District Shows:—		
Stock	£197 11 0	
Special Grants	37 0 0	
Local Societies—45 Medals	12 0 0	
Ploughing Associations—173 Medals	46 2 8	
		292 13 8
4. Cottages and Gardens—Money Premiums, £6; 25 Minor Silver Medals, £6, 13s. 4d.		12 13 4
5. Veterinary Department—Medals to Students		17 10 0
6. Agricultural Class, Edinburgh University		10 0 0
		£2677 6 11

STATE OF THE FUNDS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

At 30th NOVEMBER 1893.

I. BONDS—			
Heritable Bonds—£11,000 at 4¼ per cent, £1,300 at 4 per cent, £4,000 at 3¾ per cent, £850 at 3½ per cent . .			£17,150 0 0
II. DEBENTURE STOCKS—			
£4,250 North British Railway Company 3 per cent, at £101½		£4,313 15 0	
£2,727 Caledonian Railway Company 4 per cent, at £135¾		3,701 18 0	
£1,334 London and North-Western Railway Company 3 per cent, at £105 . .		1,400 14 0	
			9,416 7 0
III. BANK STOCKS—			
Royal Bank of Scotland, at £234 . . .	£6,407 7 8	£14,993 5 6	
Bank of England, at £330 .	2,218 16 5	7,322 2 0	
British Linen Company Bank, at £378 . . .	2,500 0 0	9,450 0 0	
National Bank of Scotland, at £335 . . .	1,250 0 0	4,187 10 0	
Commercial Bank of Scotland (equivalent to 54 shares of £100 each, £20 paid), at £68, 15s. per share of £20 paid . . .	1,080 0 0	3,712 10 0	
Bank of Scotland, at £326 .	1,741 13 4	5,677 16 8	
			45,343 4 2
	£15,197 17 5		

Note.—The original cost of these Bank Stocks was £26,012, 3s. 4d., showing a profit, at present prices, of £19,331, 0s. 10d.

IV. ESTIMATED VALUE of Building, No. 3 George IV. Bridge .	3,100 0 0
V. ESTIMATED VALUE of Furniture, Paintings, Books, &c. . .	1,000 0 0
VI. ARREARS OF MEMBERS' SUBSCRIPTIONS considered recoverable	61 19 0
VII. BALANCE DUE BY ROYAL BANK OF SCOTLAND ON ACCOUNT CURRENT, at 30th November 1893	771 9 10
AMOUNT OF GENERAL FUNDS . . .	£76,843 0 0
VIII. TWEEDDALE MEDAL FUND—	
Heritable Bond, at 3¾ per cent	£500 0 0

Note.—The Building Fund and Value of Furniture have now been included under the General Funds.

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, *2d January* 1894.

ABSTRACT of the ACCOUNTS of the HIGHLAND and

CHARGE.

1. DEPOSIT with Royal Bank of Scotland in name of "Building Fund," dated 11th November 1892			£119 16 11
2. ARREARS of Subscriptions outstanding at 30th Nov. 1892		£50 15 6	
Whereof due by Members who have compounded for life, and are thereby extinguished . . .	£4 13 6		
Sums ordered to be written off .	17 4 0		
		21 17 6	
			28 18 0
3. INTERESTS AND DIVIDENDS—			
(1) Interest on Heritable Bonds, less Income-tax		£676 13 4	
(2) Interest on Debenture Stock, do.		269 0 6	
		£945 13 10	
Deduct.—Interest on Overdraft on Account Current with Royal Bank of Scotland for year to 30th November 1893. . . .	£16 17 3		
Less.—Interest on Deposit Receipt per £492, 11s. from 11th Nov. 1892 to 19th Jan. 1893 .	1 6 7		
		15 10 8	
		£930 3 2	
(3) Dividends on Bank Stocks—			
£6,407 7 8 Royal Bank of Scotland .	£576 13 2		
2,218 16 5 Bank of England	216 6 7		
2,500 0 0 British Linen Co. Bank . .	340 0 0		
1,250 0 0 National Bank of Scotland .	187 10 0		
1,080 0 0 Commercial Bank of Scotland .	151 4 0		
1,091 13 4 Bank of Scotland . .	141 18 4		
		1,613 12 1	
(4) Dividend on 10 shares, British Fisheries Society		10 0 0	
			2,553 15 3
4. INCOME from Building Fund—			
Interest on Heritable Bond per £350 for one and a half year, less Income-tax		£17 11 3	
Interest on Deposit Receipt with Royal Bank of Scotland		0 5 0	
			18 3 3
5. SUBSCRIPTIONS—			
Annual Subscriptions		£874 8 0	
Life Subscriptions		937 15 6	
			1,812 3 6
6. RECEIPTS in connection with former Shows			138 0 0
7. TRANSACTIONS—Sales from Messrs Wm. Blackwood & Sons for year 1892			20 5 8
8. SUM received from Government in aid of Agricultural Experiments			200 0 0
9. BALANCE of Receipts from Edinburgh Show			4,652 12 9
10. DEPOSIT RECEIPT with Royal Bank of Scotland of date 11th November 1892			492 11 0
11. CAPITAL Sum realised			305 2 6
12. MISCELLANEOUS RECEIPT			20 0 0
SUM OF CHARGE . .			£10,361 8 10

EDINBURGH, 2*d January* 1894.

AGRICULTURAL SOCIETY of SCOTLAND for the Year 1892-93.

DISCHARGE.

1. BALANCE due to Royal Bank of Scotland on Account Current at 30th Nov. 1892		£1,575 3 3
2. ESTABLISHMENT EXPENSES—		
Salaries and Wages	£928 15 2	
Retiring Allowance to late Clerk, for year to 1st October 1893	150 0 0	
Feu-duty, £28; Water Rates, £2, 3s. 4d.; Taxes, £35, 18s.	65 16 4	
Coals and Firewood, £7, 14s. 6d.; Gas, £10, 11s. 7d.; Insurance, £8, 14s. 8d.	27 0 9	
Repairs and Furnishings	100 11 10	
		1,272 4 1
3. FEE to Auditor of Accounts for 1891-92		50 0 0
4. FEE to Practical Engineer for year		20 0 0
5. AGRICULTURAL EDUCATION— Grant to Professor of Agriculture, £150; Prizes to Class, £10; Fees to Examiners, Expenses, and Luncheon, £46, 1s. 6d.		206 1 6
6. CHEMICAL DEPARTMENT—		
Salary to Chemist, £200; Allowance for Expenses, £200	£400 0 0	
Experimental Station at Pumpherston — Superintendent's Allowance, £15, 15s.; Manures, &c., £12, 17s. 10d.	28 12 10	
District Experiments—Manures and Carriage, £62, 9s. 2d.; Experimenters' Outlays and Expenses, £18, 3s. 5d.	80 12 7	
Grants to Analytical Associations	72 15 0	
Printing	8 19 0	
		590 19 5
7. VETERINARY DEPARTMENT—Fee to Professor Williams, £26, 5s.; Medals to Students, £17, 10s.		43 15 0
8. BOTANICAL DEPARTMENT—Fee to Botanist for year, £25; Botanist's Expenses visiting Messrs Garton's Experimental Farms, £4, 4s.		29 4 0
9. SPECIAL GRANTS—Vote to Kilmarnock Dairy Institute, £60; Vote to Royal Northern Agricultural Society for Dairy Education, £20; Vote to Angus and Mearns Dairy School, £20; Grant to Forestry Chair in Edinburgh University, £50		150 0 0
10. SOCIETY'S TRANSACTIONS — Printing, £232, 17s.; Binding and Postage, £134, 14s. 6d.; Woodcuts and Loan of Blocks, £3, 1s. 7d.; Delivering, £2, 2s.		372 15 1
11. ESSAYS AND REPORTS		112 16 0
12. ORDINARY Printing and Lithographing, £63, 9s. 6d.; Advertising, £23, 16s. 8d.; Stationery, Books, and Binding, £33, 14s.; Postage and Receipt Stamps, £66; Bank and Post-Office Charges and Telegrams, £5, 0s. 3d.		192 0 5
13. SUBSCRIPTIONS to Public Societies—Scottish Meteorological Society, £20; Society for Prevention of Cruelty to Animals, £5		25 0 0
14. MISCELLANEOUS EXPENSES — Secretary's Expenses visiting Shows, &c., £25, 11s. 6d.; Secretary's Expenses attending Nomination of Directors, £20, 18s.; Secretary's Expenses to London on Deputation to Railways, £7, 13s. 6d; Reporting Meetings, £21; Luncheons to Directors, £13, 14s.; Messrs Tods, Murray, & Jamieson's Business Account in connection with Investments, £7, 5s. 1d.; Storing Turnstiles and Indicators, £7, 8s. 6d.; Carriage of Turnstiles, £2, 6s. 7d.; Fees for Guarantee of Railway Stocks, £1, 17s. 4d.; Handsels, £1, 10s.		109 4 6
15. PREMIUMS—		
Inverness Show	£137 4 0	
Edinburgh Show	2,194 19 11	
	£2,332 3 11	
District Competitions	232 3 4	
Cottages and Gardens	11 7 4	
		2,575 14 7
16. PAYMENT in connection with former Show		0 3 6
17. SUBSCRIPTIONS towards Abortion Inquiry repaid		9 12 0
18. ARREARS of Subscriptions struck off as irrecoverable		41 9 6
19. ARREARS outstanding at 30th November 1893		61 19 0
20. INVESTMENTS made		2,151 17 2
21. BALANCE due by Royal Bank of Scotland on Account Current at 30th November 1893		771 9 10
SUM OF DISCHARGE		£10,361 8 10

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

VIEW OF THE INCOME AND EXPENDITURE
For the Year 1892-93.

INCOME.

1. ANNUAL SUBSCRIPTIONS AND ARREARS received			£802 4 6
2. LIFE SUBSCRIPTIONS			935 8 6
			£1,737 13 0
3. INTERESTS AND DIVIDENDS received—			
Interests	£930 3 2		
Dividends	1,623 12 1		
			2,553 15 3
4. INCOME FROM BUILDING FUND			18 3 3
5. RECEIPTS in connection with former Shows			138 0 0
6. TRANSACTIONS—Sales from Messrs Wm. Blackwood & Sons			20 5 8
7. SUM received from Government in aid of Agricultural Experiments			200 0 0
8. BALANCE OF RECEIPTS from Edinburgh Show			4,652 12 9
9. MISCELLANEOUS RECEIPTS			20 0 0
			£9,340 9 11

EXPENDITURE.

1. ESTABLISHMENT—			
Salaries and Wages		£1,078 15 2	
Feu-duties, Taxes, Coals, Gas, Insurance, Repairs and Furnishings		193 8 11	
		£1,272 4 1	
2. FEE TO AUDITOR, for 1891-92		50 0 0	
3. FEE TO PRACTICAL ENGINEER		20 0 0	
4. AGRICULTURAL EDUCATION (including Fees to Examiners)		206 1 6	
5. CHEMICAL DEPARTMENT		590 19 5	
6. VETERINARY DEPARTMENT		43 15 0	
7. BOTANICAL DEPARTMENT		29 4 0	
8. SPECIAL GRANTS		150 0 0	
9. TRANSACTIONS		372 15 1	
10. ESSAYS AND REPORTS		112 16 0	
11. ORDINARY Printing, Advertising, Stationery, Postages, and Bank Charges		192 0 5	
12. SUBSCRIPTIONS to Public Societies		25 0 0	
13. MISCELLANEOUS		109 4 6	
14. PREMIUMS—			
Inverness Show	£137 4 0		
Edinburgh Show	2,194 19 11		
District Competitions	232 3 4		
Cottages and Gardens	11 7 4		
		2,575 14 7	
15. PAYMENTS in connection with former Shows		0 3 6	
16. SUBSCRIPTIONS towards Abortion Inquiry repaid		9 12 0	
SUM OF EXPENDITURE			5,759 10 1
BALANCE OF INCOME			£3,580 19 10

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 2d *January* 1894.

ABSTRACT of the ACCOUNTS of the ARGYLL NAVAL FUND for 1892-93.

CHARGE.

1. FUNDS as at 30th November 1892—			
£3193, 6s. 8d. Debenture Stock of the North British Railway Company, purchased at			£2,650 0 0
Funded Debt of the Clyde Navigation Trustees, £3,000, purchased at			2,970 0 0
Stock of the Royal Bank of Scotland, £305, purchased at .			671 0 0
			£6,291 0 0
BALANCE in Royal Bank of Scotland on Account Current .			332 11 10
			£6,623 11 10
2. INCOME received—			
On £3,193, 6s. 8d. North British Railway Company Debenture Stock at 3 per cent, £95, 16s., tax £2, 12s. 9d.	£93 3 3		
On £3,000 Funded Debt of the Clyde Navigation Trustees at 4 per cent, £120, tax £3, 5s. .	116 15 0		
On £305 Royal Bank Stock	27 9 0		
			£237 7 3
SUM OF CHARGE . .			£6,860 19 1

DISCHARGE.

1. ALLOWANCE to the five following Recipients—			
John Allan Gregory, first year			£40 0 0
C. D. L. MacEwan, third year			40 0 0
Godfrey George Webster, fourth year			40 0 0
C. W. Campbell Strickland, fifth year			40 0 0
Colin Mackenzie, fifth year			40 0 0
			£200 0 0
2. FUNDS as at 30th November 1893—			
£3,193, 6s. 8d. Debenture Stock of the North British Railway Company, purchased at .	£2,650 0 0		
Funded Debt of the Clyde Navigation Trustees, £3,000, purchased at	2,970 0 0		
Stock of the Royal Bank of Scotland, £305, purchased at	671 0 0		
	£6,291 0 0		
Balance in Royal Bank of Scotland on Account Current	369 19 1		
			6,660 19 1
SUM OF DISCHARGE, . .			£6,860 19 1

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, *2d January* 1894.

ABSTRACT of the ACCOUNTS

CHARGE.

1. Local Subscriptions—		
Counties of Edinburgh, Haddington, and Linlithgow		£871 1 2
Town Council of Edinburgh		210 0 0
		£1,081 1 2
2. Amount Collected during Show—		
Drawn at Gates	£4,208 11 0	
Drawn at Grand Stand	314 18 3	
Catalogues and Awards sold	361 17 6	
Drawn at Block-Test Competition	11 14 0	
Hire of Chairs	13 0 4½	
Drawn at Lavatory	7 6 11	
		4,917 8 0½
3. Rent of Stalls		2,093 1 6
4. Rent of Refreshment Booths		267 10 0
5. Rent of Dean Park		77 0 0
6. Income from Tweeddale Medal Fund		18 4 8
7. Fines for Non-Exhibition of Live Stock		88 12 0
8. Subscriptions in Aid of Premiums		426 4 0
9. Drawn at Exhibition of Binders		9 0 6
10. Advertising in Catalogue		134 5 0
11. Interest from Royal Bank		20 9 6
		£9,132 16 4

Note.—From the above Balance of	£2,457 12 10
There must be deducted the Premiums undrawn at 30th November 1893, amounting to	134 10 0
Making the Probable Surplus	£2,323 2 10

Edinburgh, 2d *January* 1894.

of the EDINBURGH SHOW, 1893.

DISCHARGE.

1. SHOWYARD EXPENDITURE—			
Fitting up Showyard			£2,540 10 0
Rent Dean Park			150 0 0
Repairing Hurdles for Sheep Pens			35 10 0
Rosettes			32 5 0
Turnstiles			18 6 0
Removing and restoring Fences			9 16 10
Hire of Chairs			7 10 0
Cutting Grass on Dean Park			7 8 0
Flags			7 13 6
Tin Boxes for Prize Tickets			4 16 6
Inspecting Grand Stand			3 3 0
Railway Carriages and Cartage of Turnstiles, Boxes, &c.			8 17 4
Miscellaneous			11 15 2
			£2,837 11 4
2. FORAGE FOR STOCK			374 5 4½
3. POLICE			99 13 3
4. TRAVELLING EXPENSES of Judges, Stewards, &c.			57 8 7
5. HOTEL AND LUNCHEONS—			
Hotel Bill for 27 Directors, 5 Stewards, 27 Judges, and gratuities to servants	£146 13 6		
Luncheons in Showyard for Judges, Directors, Attending Members, and Members of Committee, and Breakfasts for Stewards, Assistants, &c.	74 12 8		
Luncheon to Lord Mayor of Dublin and Party	9 5 0		
			230 11 2
6. MUSIC in Showyard			59 15 6
7. PRINTING			313 13 0
8. ADVERTISING and Bill-posting			108 12 2
9. VETERINARY INSPECTION			10 10 0
10. BEE EXHIBITION			20 13 4
11. WORKING DAIRY			40 10 0
12. HIGHLAND INDUSTRIES			14 0 1
13. EXHIBITION OF BINDERS—			
Tenant of Field for Labour	£8 10 0		
Travelling Expenses, Luncheons, Police, Catalogue Boys, Attendants, &c.	18 14 8		
Practical Engineer, Fees and Outlays	16 15 0		
			43 19 8
14. PRACTICAL ENGINEER FEES			77 18 6
15. EXTRA CLERKS, Yardsmen, Assistants, and Attendants at Turnstiles, Gates, &c.			129 18 0
16. POSTAGES			49 0 0
17. MISCELLANEOUS PAYMENTS			12 3 8
AMOUNT OF GENERAL EXPENSES			£4,480 3 7½
18. PREMIUMS drawn at 30th November 1893			2,194 19 11
			£6,675 3 6½
BALANCE OF RECEIPTS			2,457 12 10
			9,132 16 4½

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

PROCEEDINGS AT BOARD MEETINGS.

MEETING OF DIRECTORS, 1st FEBRUARY 1893.

Present.—Ordinary Directors—Mr Fisher, Jellyholm; Mr Wardlaw Ramsay of Whitehill; Mr Wilken, Waterside of Forbes; Mr Lockhart, Mains of Airies; Mr Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Gordon of Newton; Mr Ferguson, Pictstonhill; Mr M'Gibbon, Ardnacraig; Mr Elliot, Hollybush; Sir Robert Menzies of Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Mr Middleton, Clay of Allan; Mr Dun, Easter Kincaple; Mr Davidson, Saughton Mains; Mr Lumsden of Balmedie; Mr Lusk, Lochvale; Mr Macpherson Grant of Drumduan; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Sir Thomas D. Gibson-Carmichael of Skirling, Bart.; Captain Thomas Hope of Bridge Castle; Mr Ford, Fentonbarns; Mr Hope, Eastbarns; Mr Glendinning, Newmains; Mr Buttar, Corston; Mr Macduff of Bonhard; Mr Martin of Auchendennan; Mr Shirra Gibb, Boon. *Honorary Secretary*—Sir G. Graham Montgomery of Stanhope, Bart. *Chemist*—Dr A. P. Aitken. *Engineer*—Mr J. D. Park. Mr Wardlaw Ramsay, and afterwards Colonel Stirling, in the chair.

Mr Macdonald reported apologies for the absence of Sir Allan R. Mackenzie of Glenmuick, Bart.; Mr Aitken, Norwood; Mr Ballingall, Dunbog; Mr Cran, Kirkton; Mr Howatson of Glenbuck; Mr Mackenzie, Dalmore; Mr Murdoch, Gartcraig; Mr Pott of Dod; Mr Sinclair Scott, Burnside; Mr Speir, Newton.

Edinburgh Show.

The Prize-List for the Show, to be held at Edinburgh on the 25th July next and the three following days, was finally adjusted, and ordered to be printed for immediate circulation.

Working Dairy.

It was remitted to a Committee to consider and report as to a working dairy in the showyard.

Weighbridge Competition.

Conditions were adopted for the competition for the prize of ten guineas offered by the Scottish Farmers' Supply Association (Limited), for the best farmer's cart and cattle weighbridge at the Edinburgh Show.

Grazing of Showyard.

The Secretary was authorised to advertise and receive offers for the grazing of the Dean Park from 1st April to 30th November.

Permanent Office and Entrance for Showyard.

It was remitted to a Committee to consider and report as to providing permanent offices and entrance-gates for the Society's showyards.

ADVERTISEMENTS IN CATALOGUE.

It was decided to admit advertisements into the Show Catalogues of the Society.

CHIEF STEWARD OF SHOWYARD.

On the recommendation of a Committee it was decided that no alterations be made in the arrangements hitherto existing.

STANDING COMMITTEES.

The Standing Committees for 1893 were revised, and in some cases enlarged.

NEW MEMBERS.

A Committee was appointed to consider and report as to the best means of increasing the membership of the Society.

CHEMICAL DEPARTMENT.

The following report of the Chemical Committee was read and approved: "The Chemist reported that, owing to the failure of some of the Associations to send in statements of the analyses of manures made by them, the total number of analyses for which grants were now to be given was smaller than usual—viz., 182—and that the total amount of the grant for these was £72, 15s. Of the 182 samples of manures, the great majority were above their guarantees, and sold at prices below their valuations, according to the Society's units. Only four cases of deficiency were reported, and the Chemist was asked to inquire fully into the details of each case, and report. An experiment, No. XIX., whose object is to improve lea grass, and especially to increase the quantity and permanence of clover, was discussed, and the details adjusted."

RAILWAY RATES.

The Board took into consideration the resolution adopted by the anniversary meeting to petition the Board of Trade on the subject of increased railway rates, and a memorial to the Board of Trade was framed and adopted.

The Rev. JOHN GILLESPIE reported that on behalf of the Society he had attended a meeting on the subject at the Mansion House, London, on Monday last. He stated that that meeting was influentially attended and enthusiastic in its denunciation of the increased rates.

It was remitted to a Committee to draw up a statement on the subject to be sent to all the Agricultural Societies in Scotland, soliciting their co-operation and support in the matter.

MEETING OF DIRECTORS, 1ST MARCH 1893.

Present.—Ordinary Directors—Mr Fisher, Jellyholm; Mr Lockhart, Mains of Airies; Mr Cran, Kirkton; Hon. the Master of Polwarth, Humbie House; Mr Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Gordon of Newton; Mr Aitken, Norwood; Mr Ferguson, Pictstonhill; Mr Elliot, Hollybush; Sir Robert Menzies of Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig of Riccarton, Bart.; Rev. John Gillespie, Mouswald; Mr Middleton, Clay of Allan; Mr Pott of Dod; Mr Speir, Newton; Mr Dun, Easter Kincaple; Mr Davidson, Saughton Mains; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Ford, Fentonbarns; Mr Hope, Eastbarns; Mr Glendinning, Newmains; Sir Allan R. Mackenzie of Glenmuick, Bart.; Captain G. D. Clayhills Henderson of Invergowrie, R.N.; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Macduff of Bonhard; Mr Shirra Gibb, Boon. *Chemist*—Dr A. P. Aitken. *Auditor*—William Home Cook, C.A. *Engineer*—Mr James D. Park. Sir James Gibson-Craig, and afterwards the Rev. John Gillespie, in the chair.

Mr MACDONALD reported apologies for the absence of Sir G. Graham Montgomery of Stanhope, Bart.; the Lord Provost of Edinburgh; Mr Ballingall, Dunbog; Mr Forbes of Culloden; Mr Gilmour of Montrave; Mr Macpherson Grant of Drumduan; Mr Howatson of Glenbuck; Mr M'Gibbon, Ardnacraig; Mr Mackenzie, Dalmore; Mr Martin of Auchendennan; Mr Wardlaw Ramsay of Whitehill; Mr Sinclair Scott, Burnside; Mr Wilken, Waterside of Forbes; and Mr M'Queen of Crofts.

Edinburgh Show.

Cups by H.R.H. Duke of York.—The Secretary was instructed to convey to H.R.H. the Duke of York the thanks of the Directors for the three champion cups which H.R.H. has been good enough to present for the Edinburgh Show.

Subscription from Edinburgh Town Council.—A letter was read from Mr Skinner, the Town Clerk of Edinburgh, intimating that the Edinburgh Town Council had voted a sum of £210 towards the funds of the Edinburgh Show. The Secretary was instructed to convey the thanks of the Board to the Town Council for their handsome donation.

Railway Arrangements.—A Committee was appointed to confer with the managers of the Scottish railway companies as to facilities for the conveyance of visitors and exhibits for the Edinburgh Show.

Special Prizes for Shropshire Sheep.—A letter was read from Mr Buttar, Corston, offering, on behalf of Scottish breeders of Shropshire sheep, the following additional prizes: For three shearling Shropshire tups bred in Scotland by exhibitor, £3 and £2; for three Shropshire tup lambs bred in Scotland by exhibitor, £3 and £2; and for three Shropshire ewe lambs bred in Scotland by exhibitor, £3 and £2. The prizes were accepted with thanks.

Prizes for Oxford Down Sheep.—A letter was read from Mr Toppin, urging that prizes should be given for Oxford Down sheep. It was resolved to offer prizes for this breed as follows: (1) Best tup above one shear; (2) shearling tup; (3) three ewes above one shear; and (4) three shearling ewes, with prizes of £5 and £3 in each class.

Photographer to the Society.—On the recommendation of the General Shows Committee, it was resolved that at next meeting the Directors will be prepared to receive and consider offers from photographic firms to become photographers to the Society for the year, with the exclusive right of photographing animals in the Edinburgh showyard.

Working Dairy.—A long discussion took place as to the question of having a working dairy in the Edinburgh showyard. It was decided, by a majority of 17 to 6, not to have a working dairy in the showyard.

Milking-Machines.—On the recommendation of the General Shows Committee, it was agreed that ground be provided in the Edinburgh showyard for trial of milking-machines, and that if sufficient merit be shown by any milking-machine, a reward shall be given by the society, it being understood that the exhibitor bears all the cost of the trial except the ground-rent.

Permanent Offices and Entrance-Gates.—The proposal to provide permanent entrance-gates and offices for the showyard was remitted back to the Committee for further consideration and report.

New Members.

The Special Committee appointed on this subject recommended the adoption of the following method for increasing the membership of the Society:—

1. In every district or parish appoint a Local Committee of members of the Society.

2. The object of the Local Committee shall be to induce landowners, farmers, and others, who are not already members, to become members of the Society, and generally to promote the interest and the usefulness of the Society as an agent for the advancement of the agriculture of the country.

3. The Local Committee shall be supplied with lists of the members in their district, and with copies of printed statements setting forth (1) the privileges of members of the Highland and Agricultural Society, and (2) the objects to be gained by increasing the membership of the Society.

4. The Local Committee shall hold meetings from time to time, and shall consider and decide as to the steps to be taken with the view of obtaining new members.

The report was unanimously adopted.

Chemical Department.

The Chemical Committee reported that applications from Aberdeen and Banffshire Agricultural Societies, requesting that the Society would allow their experiments in the manuring of grass under rotation to be undertaken by selected farmers farming land in typical districts of these counties. It was agreed to comply with the application. On the recommendation of the Committee, it was resolved to utilise a portion

of Pumpherston Station to discover how most economically to improve permanent meadow-grass. The units for valuing manure were revised and adjusted for the current year, and ordered to be printed for immediate circulation.

MEETING OF DIRECTORS, 5TH APRIL 1893.

Present.—Ordinary Directors—Mr Gilmour of Montrave; Mr Fisher, Jellyholm; Mr Lockhart, Mains of Airies; Mr Cran, Kirkton; Mr Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Ferguson, Pictstonhill; Mr M'Gibbon, Ardnacraig; Mr Elliot, Hollybush; Mr Paterson, Hill of Drip; Rev. John Gillespie, Mouswald; Mr Middleton, Clay of Allan; Mr Dun, Easter Kincaple; Mr Davidson, Saughton Mains; Mr Lumsden of Balmedie; Mr Lusk, Lochvale; Mr Macpherson Grant of Drumduan; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Ford, Fentonbarns; Mr Hope, Eastbarns; Mr Glendinning, Newmains; Sir Allan R. Mackenzie of Glenmuick, Bart.; Captain G. D. Clayhills Henderson of Invergowrie, R.N.; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Macduff of Bonhard; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Hon. Secretary*—Sir G. Graham Montgomery of Stanhope, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. *Engineer*—Mr James D. Park. Mr Gilmour of Montrave in the chair.

Mr MACDONALD reported apologies for the absence of the Lord Provost of Edinburgh; Sir Robert Menzies of Menzies, Bart.; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Aitken, Norwood; Mr Gordon of Newton; Mr Martin of Auchendennan; Mr Mackenzie, Dalmore; Mr Pott of Dod; Mr Sinclair Scott, Burnside; Mr Speir, Newton Farm; Mr Wilken, Waterside of Forbes.

EDINBURGH SHOW.

Local Committee.—It was remitted to the Directors in the district to nominate a Local Committee.

Stewards.—The Stewards were appointed as follows: *Horses*—Sir A. R. Mackenzie, Bart. *Cattle*—Rev. Mr Gillespie. *Sheep, Swine, &c.*—Mr Elliot, Hollybush. *Forage*—Mr Buttar, Corston. *Parade Stand*—Mr Macduff of Bonhard. *Implements*—Mr Middleton and Mr Glendinning.

Special Prizes by Mr Howatson.—The following special prizes for blackfaced sheep, offered by Mr Howatson of Glenbuck, were accepted with thanks, the amount being £30—viz.: best pair of blackfaced tups, 3 shear or upwards, £3, £2, £1; do. 2 shear tups, £3, £2, £1; do. 1 shear tups, £3, £2, £1; do. tup lambs, £3, £2, £1; and do. ewe lambs, £3, £2, £1.

Offices and Entrance-Gates.—It was resolved that permanent entrance-gates be provided for the Society's showyard at a cost not exceeding £138. The question of providing a permanent front for the committee-room was postponed.

Bee Exhibition.—Permission was given to the Scottish Beekeepers' Association to hold their usual exhibition in the Edinburgh Show, and a grant of £20 and two silver medals was voted towards that exhibition.

Railway Arrangements.—The SECRETARY reported that the managers of the Scotch railways had been unable as yet to arrange for an interview with the Society's Committee as to the railway facilities for the Edinburgh Show. He was in correspondence with the different railway companies as to minor details in the arrangements for the conveyance of exhibits, and he hoped to be able to complete these satisfactorily. In regard to one point, the withdrawal of free passes to attendants upon live stock to and from the Show, the companies had not yet seen their way to meet the wishes of the Society, but they had expressed their willingness to receive a further representation on the subject. It was resolved (1) that the Secretary be instructed to address a letter to each of the Scotch railway companies pointing out the serious extent to which the withdrawal of these free passes would endanger the success of agricultural shows, and lessen railway traffic; (2) that a deputation be appointed to wait upon each of the managers of the Scotch railways and support that representation, and if possible to have a meeting of all the Scotch railway managers together on the subject.

The Duke of York's Prizes.—The following additional conditions were adopted for the competition for the champion cups offered by His Royal Highness the Duke of York: (1) That the competition shall be confined to the ordinary class prizes offered by the Society; (2) that an exhibitor shall not be entitled to count winnings in more than six classes for one breed of cattle, and four classes for one breed of sheep; (3)

that the driving and jumping competitions be excluded from the competition for these cups; and (4) that only one prize shall be counted for each animal.

Sweepstakes for Clydesdale Yearlings.—It was reported that the entries for the sweepstakes for yearling Clydesdale colts and fillies were as follows: Colts, 15 entries, with prizes of £5, £4, £3, and £1; and fillies, 17 entries, with prizes of £5, £4, £3, £2, and £1.

Aberdeen Show, 1894.

It was remitted to the Directors in the district to nominate a Committee to raise subscriptions for the Aberdeen Show of 1894.

Show, 1895.

It was resolved that, subject to satisfactory local arrangements, pecuniary and otherwise, the Show be held at Dumfries in 1895.

New Members.

It was reported that the Special Committee appointed to consider the best means of increasing the membership of the Society had met that morning and given the Secretary instructions upon various points connected with the movement.

Importation of Foreign Cattle.

In accordance with notice given, Mr Scott Dudgeon moved the following motion: "That it is for the real interests alike of the consumers and the producers of butcher-meat in Great Britain and Ireland that all live cattle, sheep, and swine imported into the United Kingdom should be slaughtered at the port of debarkation as the only effectual safeguard against the reimportation of disease." Mr C. Macpherson Grant seconded.

Captain Clayhills Henderson moved: "That it is injudicious that Mr Scott Dudgeon's motion be submitted to this Board." Mr Macduff, Bonhard, seconded.

After considerable discussion, the amendment was carried by 15 to 8.

Dishorning Cattle.

Mr Gilbert called attention to the fact that the Scottish Society for the Prevention of Cruelty to Animals, to which the Highland and Agricultural Society gave an annual contribution, had intimated their intention to take steps to get the dishorning of cattle in Scotland declared an illegal act.

After some discussion, the following resolution, moved by Mr Gillespie, and seconded by Mr Macduff, was adopted unanimously: "That as it appears from the report of the general meeting of the Scottish Society for the Prevention of Cruelty to Animals that the Directors of that Society propose to take steps to get the dishorning of cattle in Scotland declared an illegal act, the Board of the Highland and Agricultural Society, as subscribers to its funds, resolve to intimate to the said Directors its disapproval of their proposed action."

Conditions Attaching to Prizes.

On the motion of the Rev. John Gillespie, seconded by Mr Elliot, the following resolution was adopted by seven votes to three—viz.: "That it is not expedient to accept prizes confined to stock bred in Scotland." It was understood that the resolution does not affect the Show of this year.

Grant from Government.

A letter was read from the Board of Agriculture forwarding a grant of £200 in consideration of the agricultural experiments conducted by the Society during the past year.

Rothamsted Jubilee Fund.

A letter was read from the Duke of Westminster asking the co-operation of the Society in the movement set on foot for the celebration of the jubilee of the Rothamsted experiments conducted by Sir John Bennet Lawes and Dr Gilbert. The Board cordially commended the object to the support of all interested in agricultural research, and nominated Sir George Macpherson-Grant, Bart., to represent the Society on the Executive Committee.

MEETING OF DIRECTORS, 3D MAY 1893.

Present.—Ordinary Directors—Mr Gilmour of Montrave; Mr Fisher, Jellyholm; Hon. the Master of Polwarth, Humbie House; Mr Ferguson, Pictstonhill; Mr Elliot, Hollybush; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Mr Middleton, Clay of Allan; Mr Pott of Dod; Mr Dun, Easter Kincaple; Mr Davidson, Saughton Mains; Mr Lumsden of Balmedie; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Ford, Fentonbarns; Mr Hope, Eastbarns; Mr Glendinning, Newmains; Mr Buttar, Corston; Mr Mackenzie, Dalmore; Mr Macduff of Bonhard; Mr Howatson of Dornel; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. *Engineer*—Mr James D. Park. The Hon. the Master of Polwarth in the chair.

Mr MACDONALD reported apologies for the absence of Sir Robert Menzies of Menzies, Bart.; Mr Aitken, Norwood; Mr Cran, Kirkton; Mr Forbes of Culloden; Mr Glendinning, Hatton Mains; Mr Gordon of Newton; Mr Lockhart, Mains of Airies; Mr Martin of Auchendennan; Mr Paterson, Hill of Drip; Right Hon. Lord Polwarth, Mertoun House; Major Wardlaw Ramsay of Whitehill; Mr Sinclair Scott, Burnside; Mr Speir, Newton Farm; Colonel Stirling of Kippendavie; Mr Wilken, Waterside of Forbes.

GENERAL MEETING.

It was agreed that the half-yearly general meeting of the Society be held on Wednesday, the 14th of June next.

EDINBURGH SHOW, 1893.

Local Committee.—The names of the Local Committee of Superintendence for the Edinburgh Show, as nominated by the Directors on the 26th ult., were submitted.

Hotel Accommodation and Refreshments in Yard.—It was remitted to the Secretary to make the necessary hotel arrangements for the accommodation of the Directors and Judges. It was remitted to a small Committee to consider and report as to the arrangements for providing refreshments in the showyard.

Special Prizes for Ayrshire Cattle.—A letter was read from the Secretary of the Ayrshire Cattle Herd-Book Society, offering two cups of the value of £10 each for the best bull and the best cow in the yard of the Ayrshire breed, and entered in the Ayrshire Herd-Book. The prizes were accepted with thanks.

Railway Arrangements.—It was reported that the efforts to induce the railway companies to continue free passes to attendants on stock had not been successful, the Scottish railway companies stating that after full consideration they had decided to adhere to the arrangement adopted by the English railways—viz., to carry attendants on stock at half fare for the return journey. The following Committee was appointed to confer with the railway companies as to special fares and excursion trains for conveying the public to and from the Show—viz.: Sir James Gibson-Craig, Bart., *Convener;* Mr G. R. Glendinning, Mr Hope, and Mr Davidson.

ABERDEEN SHOW, 1894.

The SECRETARY reported that on Friday last he attended at Aberdeen a meeting of the Directors in the Aberdeen Show district, when a Local Committee was appointed to raise subscriptions in aid of the Show of next year.

REPORTING BOARD MEETINGS.

Mr W. S. FERGUSON, in accordance with notice given, moved that reporters be admitted to the meetings of the Board. Mr SCOTT DUDGEON seconded.

The Rev. JOHN GILLESPIE moved that the following Committee be appointed to confer with the Secretary as to reports of the meetings of the Board, and report to a future meeting—viz.: Sir James Gibson-Craig, *Convener;* Rev. John Gillespie, Mr Scott Dudgeon, Mr Jonathan Middleton, Mr Gilmour, and Mr Ferguson. Mr MIDDLETON seconded.

On a division, after some discussion, Mr Gillespie's amendment was carried by 13 to 4.

DISHORNING OF CATTLE.

A letter was read from the Secretary of the Scottish Society for the Prevention of Cruelty to Animals, acknowledging receipt of the resolution at last meeting of the Board, and stating that the Directors of his Society had no intention at present to take any steps or any action to get dishorning of cattle declared illegal in Scotland.

RAILWAY RATES.

Mr GILLESPIE stated that a Committee of the House of Commons had been appointed to inquire into the manner in which the railway companies had acted under the recent powers given to them under the Provisional Order. Mr Gillespie was authorised, if called upon, to give evidence before the Committee on behalf of the Society.

ABORTION IN CATTLE.

On the motion of Mr GILLESPIE, it was decided to urge the Board of Agriculture to conduct an investigation into the causes of abortion in cattle.

MEETING OF DIRECTORS, 7TH JUNE 1893.

Present.—Ordinary Directors—Mr Fisher, Jellyholm; Mr R. G. Wardlaw Ramsay of Whitehill; Mr Cran, Kirkton; Mr G. R. Glendinning, Hatton Mains; Mr A. M. Gordon of Newton; Mr Aitken, Norwood; Mr Ferguson, Pictstonhill; Mr Elliot, Hollybush; Mr Sinclair Scott, Burnside; Sir Robert Menzies of Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig of Riccarton, Bart.; Rev. John Gillespie, Mouswald; Mr Middleton, Clay of Allan; Mr Pott of Dod; Mr Speir, Newton; Mr Dun, Easter Kincaple; Mr Lusk, Lochvale; Mr Macpherson Grant of Drumduan; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Lord Provost Russell; Bailie Walcot, Edinburgh; Mr Ford, Fentonbarns; Captain G. D. Clayhills Henderson of Invergowrie, R.N.; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Macduff of Bonhard; Mr Howatson of Dornell; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. *Engineer*—Mr James D. Park. Sir James Gibson-Craig, and afterwards Captain Clayhills Henderson, occupied the chair.

The SECRETARY reported apologies for the absence of the Hon. the Master of Polwarth; Sir G. Graham Montgomery of Stanhope, Bart.; Mr Davidson, Saughton Mains; Mr Forbes of Culloden; Mr Gilmour of Montrave; Mr Glendinning, Newmains; Mr Lockhart, Mains of Airies; Mr M'Gibbon, Ardnacraig; Mr Marr, Cairnbrogie; Mr Martin of Auchendennan; Colonel Stirling of Kippendavie.

MINUTES.

The Minutes of the meeting of Directors of 3d May 1893 were approved of.

THE EDINBURGH SHOW.

Attending Members.—The attending members for the various classes of stock were appointed.

Hotel Accommodation.—The SECRETARY reported that he had arranged with Mr Macgregor of the Royal Hotel for accommodation for Directors and Judges attending the Show.

Music in Showyard.—The SECRETARY reported that he had arranged for the attendance of the band of the 1st Argyll and Sutherland Highlanders in the showyard on Wednesday, Thursday, and Friday, and that the band of the boy pipers from the Industrial School, Liberton, would play in the showyard from 5 to 8 P.M. on Wednesday and Thursday.

Refreshment Catering.—It was remitted to a small Committee to arrange for the catering in the showyard, power being given to them to provide for increased facilities.

Railway Passes for Attendants on Stock.—The Secretary reported that the railway companies had now agreed to continue the practice of issuing free passes for attendants upon show stock.

Working Dairy.—It was remitted to a Committee to arrange, if practicable, for a working dairy in the showyard.

Weighbridge Competition.—It was remitted to the Stewards of Implements to carry out the arrangements for the weighbridge competition, for which judges were appointed. It was arranged that a place in the showyard be set apart for the weighbridges on trial.

Prizes for Produce of Thoroughbred Stallions.—A letter was read from Captain Clayhills Henderson, calling attention to the wording of the conditions for the prizes offered by him, which read as follows in the prize-list: "For yearling colt or filly, the

produce of thoroughbred stallions that have served in Scotland in 1892, out of mares of any breed." Captain Henderson stated that the mention of the particular year had been put in in error, and he asked that the date be altogether expunged, and that the conditions shall read as follows: "For yearling colt or filly, the produce of thoroughbred stallions that have served in Scotland, out of mares of any breed." This was agreed to.

Police Arrangements.—It was remitted to the Secretary to arrange with the Chief-Constable of Edinburgh as to the police supervision of the Show.

Judging-Rings.—It was decided that the judging-rings for cattle and horses should be formed of wooden railing.

Reporting Board Meetings.

The Special Committee appointed at last meeting to consider this subject reported as follows: (1) That a summarised report such as is now prepared by the Secretary be as heretofore sent to the daily press on the day of meeting; and (2) that a thoroughly qualified reporter be employed to attend Board meetings, take shorthand notes of the proceedings, and prepare a report thereof sufficiently extended to embrace the substance of discussion on all matters of public interest coming before the Board, the Secretary to supply that extended report to the agricultural papers and other journals that may desire to have it for publication.

Mr W. S. Ferguson said that, as the mover of the motion at last meeting, he thought this method would be the best for all practical purposes, and he hoped that the public would be satisfied with it.

Exhibition of Binders.

The Secretary reported that the Machinery Committee had met that morning and adjusted the regulations for the exhibition of binders at work in the Edinburgh district. A small Committee was appointed to look out for a suitable field for the trial, and the following gentlemen were appointed as stewards to carry out the arrangements: Mr Jonathan Middleton, Mr G. R. Glendinning, Mr Scott Dudgeon, Dr Shirra Gibb, Mr A. S. Logan, Mr J. T. Paterson, Mr Walter Elliot, Mr D. Fisher, and Mr J. D. Park.

Saturday, the 8th of July, was fixed as the last day for receiving entries for this exhibition.

Forestry Chair.

The Secretary reported that the Forestry Committee had met that forenoon. It was found that the sum now collected by the Society in aid of the funds for the endowment of the Chair amounted to £586, of which £500 was invested in Caledonian Railway debenture stock.

It was agreed to pay the interest of the money in the Society's hands to the Lecturer on Forestry in Edinburgh University, and also to recommend the University of Edinburgh and the Royal Scottish Arboricultural Society to do the same with the interest of the funds in their hands.

Aberdeen Show.

The Secretary was instructed to make application to the Town Council of Aberdeen for the use of the Aberdeen Links for the Show of 1894.

General Meeting.

The programme of business for the general meeting on Wednesday, 14th June, was adjusted.

Sale of Live Stock.

A letter was read from Mr George Bruce, Aberdeen, asking if a sale of live stock could be held in conjunction with the Edinburgh Show. It was agreed that the Society could not take the initiative in this matter.

Block Test.

A letter was read from Messrs Wood & Sons, Glasgow, asking permission to conduct a block test on their stand in the Show. The Board could not see its way to comply with the request.

Mr Dun gave notice that at the meeting of the Directors on the 14th June he would move that the Society conduct a block test on each day of the Show, killing a bullock and a heifer alternately.

Milking-Machine.

It was remitted to the Stewards of Implements to make arrangements for the trial of a milking-machine in the Edinburgh showyard.

MEETING OF DIRECTORS, 14th JUNE 1893.

Present.—Vice-President—Mr Forbes of Culloden in the chair. *Ordinary Directors*—Mr Gilmour of Montrave; Mr Fisher, Jellyholm; Mr Wardlaw Ramsay of Whitehill; Mr Lockhart; Hon. the Master of Polwarth; Colonel Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Gordon of Newton; Mr Aitken, Norwood; Mr Ferguson, Pictstonhill; Mr M'Gibbon, Ardnacraig; Mr Elliot, Hollybush; Mr Sinclair Scott, Burnside; Sir Robert Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Mr Speir, Newton Farm; Mr Davidson, Saughton Mains; Mr Lumsden of Balmedie; Mr Lusk, Lochvale; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Ford, Fentonbarns; Mr Hope, Eastbarns; Captain Clayhills Henderson, R.N.; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Mackenzie, Dalmore; Mr Macduff of Bonhard; Mr Martin of Auchendennan; Mr Howatson of Glenbuck; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Chemist*—Dr A. P. Aitken. *Engineer*—James D. Park.

The business referred to the Edinburgh Show and the arrangement of the programme for the general meeting.

MEETING OF DIRECTORS, 1st NOVEMBER 1893.

Present.—Ordinary Directors—Mr Gilmour of Montrave; Mr Wardlaw Ramsay of Whitehill; Mr Lockhart, Mains of Airies; Mr Cran, Kirkton; the Hon. the Master of Polwarth, Humbie House; Colonel Stirling of Kippendavie; Mr G. R. Glendinning, Hatton Mains; Mr Ferguson, Pictstonhill; Mr Elliot, Hollybush; Mr Sinclair Scott, Burnside; Sir Robert Menzies of Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald Manse; Mr Middleton, Clay of Allan; Mr Speir, Newton Farm; Mr James J. Davidson, Saughton Mains; Mr Lumsden, Balmedie; Mr Macpherson Grant of Drumduan; Mr S. Dudgeon, Longnewton. *Extraordinary Directors*—Mr A. Glendinning, Newmains; Captain G. D. Clayhills Henderson of Invergowrie, R.N.; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Macduff of Bonhard; Mr Howatson of Dornel; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Home Cook, C.A. *Botanist*—Mr A. N. M'Alpine. *Engineer*—Mr J. D. Park. Mr Gilmour of Montrave in the chair.

The Secretary reported apologies for the absence of Sir G. Graham Montgomery of Stanhope, Bart.; Sir William Walker, K.C.B.; Mr Aitken, Norwood; Mr Callander of Preston Hall; Mr Dun, Easter Kincaple; Mr Fisher, Jellyholm; Mr Forbes of Culloden; Mr Gordon of Newton; Mr M'Gibbon, Ardnacraig; Mr Martin of Auchendennan; Mr Pott of Dod; and Mr Wilken, Waterside of Forbes.

Deceased Members.

Before proceeding to the business on the programme, the Directors resolved to record in the minutes the deep regret with which they had received intimation of the death of the Right Hon. Viscount Stormont, of Mr Harry Young of Cleish Castle, and of Mr Thomas Ferguson, Kinochtry.

Royal Addresses.

The Secretary submitted acknowledgments of the addresses presented by the Society to her Majesty the Queen, the Prince and Princess of Wales, the Duke of York, and the Princess May, on the occasion of the marriage of the Duke of York.

Rothamsted Jubilee.

A letter was read from Sir John B. Lawes, Bart., thanking the Society for the address of congratulation presented to him on the occasion of the Rothamsted jubilee. Sir John remarked: "In thanking the members of the Society for their very kind wishes, I cannot but feel what a very high honour they have paid me in thus publicly recognising the work of my life, and I sincerely trust that when it passes into other hands the work may be carried on with increasing utility."

Chairman of Directors.

The following motion by the Rev. Mr Gillespie was unanimously adopted: "That a small Committee be appointed to report on the advisability of appointing a Chairman of Directors to preside at the meetings of the Board."

Edinburgh Show.

Accounts.—A draft summary of the accounts of the late Show held in Edinburgh was submitted, showing a probable surplus of a little over £2000.

Transference of Members' Tickets.—A list of members whose tickets had been transferred at the recent Show was submitted, and each case considered individually.

Repayment of Entrance Money to Members.—A number of applications were submitted from members of the Society for the repayment of money which they had paid for admission to the Show on account of their being unable to present their members' tickets at the gates. The Directors considered that in view of the precise regulations applying to tickets the money could not be refunded.

Milking-Machine.—On the recommendation of the Stewards of Implements, the Board agreed to award a medium silver medal to Messrs Struthers, Weir, & Co., for their milking-machine exhibited at work in the Show.

Aberdeen Show, 1894.

Site for Show.—A letter was read from the Town Clerk of Aberdeen granting the use of the Links as formerly for the showyard. The Secretary was instructed to convey the thanks of the Directors to the Town Council of Aberdeen.

Special Prizes.—Some discussion having taken place as to the desirability of having early intimation of special prizes, it was resolved that the last date for receiving intimations of special prizes be altered from the 1st of April to the 1st of March.

An offer of two gold medals from the Polled Cattle Society for the best male and best female of the Aberdeen-Angus breed in the showyard was accepted with thanks.

Judges' Reports.—It was decided to discontinue the practice of asking the Judges for written reports on the stock adjudicated on by them.

Exhibition of Binders at Work.—On the recommendation of the Machinery Committee, it was decided to hold an exhibition of binders at work in the Aberdeen Show district next year.

Trial of Manure-Distributors.—The Machinery Committee recommended that prizes of £10 and £5 be offered at a trial of manure-distributors to be held in the Aberdeen Show district next year. The recommendation was agreed to.

Publications.

The Secretary reported that the Publications Committee had had under consideration the arrangements for next year's 'Transactions.'

Advertising in Society's Publications.

The Secretary stated that the experiment of including advertisements in the Show Catalogue had been attended with success. The Board resolved that advertisements be accepted for the Premium-List of the Aberdeen Show as well as for the Show Catalogue, and that a limited number of pages of advertisements should be accepted for the forthcoming volume of the 'Transactions.'

Forestry.

It was reported that the subscriptions received by the Society for the endowment of the Chair of Forestry in Edinburgh University amounted to £640. It was agreed to hand over this sum to the University for investment. It was also agreed that further steps should be taken to obtain additional subscriptions.

Nomination of Directors.

The Secretary reported the results of the meetings for the nomination of Directors in the various show districts. The report showed that the members nominated as Ordinary Directors are as follows—viz.: *Glasgow District*—Alexander Cross of Knockdow. *Perth District*—Captain Clayhills Henderson of Invergowrie. *Stirling District*—W. T. Malcolm, Dunmore Home Farm. *Edinburgh District*—Captain Robert Dundas, yr. of Arniston. *Aberdeen District*—George Cowe, Balhousie. *Dumfries District*—James Lockhart, Mains of Airies. *Inverness District*—C. N. Cameron, Balnakyle. *Border District*—Hon. the Master of Polwarth.

Office-Bearers.

A Committee was appointed to prepare a list of office-bearers and report to next meeting of the Board.

Messrs Garton's Experiments.

Mr M'Alpine, the Society's Botanist, reported that in accordance with instructions he had visited the experiments on the propagating of new varieties of grain by the Messrs Garton, at Newton-le-Willows, Lancashire. He was deeply impressed with the importance of the experiments, and urged that the matter should receive further attention from the Directors.

It was remitted to a Special Committee to further consider the subject and report to the Board.

MEETING OF DIRECTORS, 6th DECEMBER 1893.

Present.—Ordinary Directors—Mr Fisher, Jellyholm; Mr R. G. Wardlaw Ramsay of Whitehill; Mr Wilken, Waterside of Forbes; Mr Lockhart, Mains of Airies; Mr Cran, Kirkton; the Hon. the Master of Polwarth, Humbie House; Mr G. R. Glendinning, Hatton Mains; Mr Gordon of Newton; Mr Aitken, Norwood; Mr Ferguson, Pictstonhill; Sir Robert Menzies of Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald Manse; Mr Middleton, Clay of Allan; Mr Spier, Newton; Mr Dun, Easter Kincaple; Mr Lumsden of Balmedie; Mr Macpherson Grant of Drumduan; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Glendinning, Newmains; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Macduff of Bonhard; Mr Martin of Auchendennan; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park. *Veterinary Surgeon*—Professor Williams. Sir James H. Gibson-Craig of Riccarton, Bart., in the chair.

The Secretary reported apologies for the absence of Sir Allan R. Mackenzie of Glenmuick, Bart.; Mr Davidson, Saughton Mains; Mr Elliot, Hollybush; Mr Forbes of Culloden; Mr Ford, Fentonbarns; Mr Gilmour of Montrave; Captain G. D. Clayhills Henderson of Invergowrie, R.N.; Mr Mackenzie, Dalmore; Mr Pott of Dod; Mr Sinclair Scott, Burnside.

General Meeting.

The annual general meeting of the Society was fixed for 17th January 1894.

Chairman of Directors.]

On the recommendation of a Special Committee appointed to consider the subject, it was agreed to introduce a new by-law authorising the Directors to, from year to year, appoint one of their number to act as Chairman at the meetings of the Board.

Aberdeen Show.

Prize-List.—It was reported that the prize-list for the Aberdeen Show was being revised by the General Shows Committee, and would be submitted to the next meeting of the Board.

Special Prizes.—An offer of £10 by Mr Macpherson Grant as prizes for the three-year-old Aberdeen-Angus cows was accepted with thanks.

An offer of £10 by Mr James Lockhart for the best Clydesdale stallion was accepted with thanks.

An offer from Mr Gilmour of Montrave of £25 as prizes for yearlings the produce of thorough-bred stallions was accepted with thanks.

In accordance with the desire of the Clydesdale Horse Society, it was resolved that the Cawdor Challenge Cup for the best Clydesdale female be competed for at the Aberdeen Show.

An offer by Mr Howatson of Glenbuck of prizes for black-faced sheep amounting to £60 was, after discussion, accepted with thanks.

FORESTRY CHAIR.

Sir ROBERT MENZIES, Bart., moved—"That the £150 hitherto paid to the Professor of Agriculture in the University of Edinburgh, about to be discontinued, be paid now to the Chair of Forestry." Mr MACPHERSON GRANT seconded, and on a division the motion was lost by 5 votes against 19 for the previous question.

GENERAL PURPOSES COMMITTEE.

On the motion of Sir JAMES GIBSON-CRAIG, it was agreed to add a General Purposes Committee to the Standing Committees of the Society.

TUBERCULOSIS.

Mr JOHN SPEIR moved that the Society's Veterinary Surgeon be instructed to make tests as to the value of tuberculin in the detection of tuberculosis in cattle.

Professor WILLIAMS having stated that he believed that tuberculin was a most reliable test as to the existence of tuberculosis in animals, further consideration of the matter was delayed until the report of the Government Commission had been issued.

CHEMICAL DEPARTMENT.

Pumpherston Station.—It was decided that this station be discontinued, but that the Society's Chemist make observations as to the produce of the station during the next two years.

Fertilisers Act.—The Chemical Committee recommended that in view of the fact that the Fertilisers and Feeding Stuffs Act of 1893, which comes into operation on the 1st of January next, places upon County Councils the duty of protecting farmers from the sale of inferior manures and feeding-stuffs, the Society's grants for analyses of manures and feeding-stuffs through local analytical associations be discontinued after 1st March next.

After some discussion, the recommendation of the Committee was approved of by a large majority.

DISTRICT SHOWS.

The report by the Committee as to grants to local societies was read and approved of. The special grants recommended included a sum of £20 towards the Kilmarnock Cheese Show.

LOUPING-ILL.

On the recommendation of the Veterinary Committee, a sum of £50 was voted for an investigation by Professor Williams as to the cause and cure of louping-ill in sheep.

MEETING OF DIRECTORS, 3D JANUARY 1894.

Present.—Ordinary Directors—Mr Gilmour of Montrave; Mr Fisher, Jellyholm; Mr Lockhart, Mains of Airies; Mr G. R. Glendinning, Hatton Mains; Mr Ferguson, Pictstonhill; Mr M'Gibbon, Ardnacraig; Mr Elliot, Hollybush; Mr Sinclair Scott, Burnside; Sir Robert Menzies of Menzies, Bart.; Mr Paterson, Hill of Drip; Sir J. H. Gibson-Craig of Riccarton, Bart.; Rev. John Gillespie, Mouswald; Mr Middleton, Clay of Allan; Mr Speir, Newton Farm; Mr Dun, Easter Kincaple; Mr James I. Davidson, Saughton Mains; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Glendinning, Newmains; Sir Allan R. Mackenzie of Glenmuick, Bart.; Captain G. D. Clayhills Henderson of Invergowrie, R.N.; Mr Buttar, Corston; Mr Murdoch, Gartcraig; Mr Mackenzie, Dalmore; Mr Macduff of Bonhard; Mr Martin

of Auchendennan; Mr Howatson of Dornel; Mr Shirra Gibb, Boon; Mr Ballingall, Dunbog. *Chemist*—Dr A. P. Aitken. *Engineer*—Mr J. D. Park. Mr John Gilmour of Montrave in the chair.

The SECRETARY reported apologies for the absence of Sir G. Graham Montgomery of Stanhope, Bart.; Mr Aitken, Norwood; Mr Cran, Kirkton; Mr Gordon of Newton; Mr Macpherson Grant of Drumduan; Mr Lumsden of Balmedie; Mr Pott of Dod; Mr Wardlaw Ramsay of Whitehill; Colonel Stirling of Kippendavie; Mr Wilken, Waterside of Forbes.

OFFICE-BEARERS.

The SECRETARY submitted the list of office-bearers for next year, to be recommended for election at the general meeting on the 17th inst. The list has been already advertised. The Duke of York again agreed to accept the presidency of the Society for the year 1894, and it will be learned with satisfaction that his Royal Highness has taken this step with the view of being present at the Show in Aberdeen in July next.

FINANCE.

The accounts for 1892 and 1893, as prepared by the Auditor and approved by the Finance Committee, were laid on the table, and will be submitted to the general meeting on the 17th inst. Printed copies of the accounts may be had from the Secretary.

ABERDEEN SHOW.

Prize-List.—It was reported that the General Shows Committee had made further progress in the preparation of the prize-list, and it was decided that it should be submitted in proof to the meeting of the Board on the forenoon of the 17th instant.

Special Prize.—An offer by the Shorthorn Society of a special prize of £20 for the best shorthorn bull in the yard entered or eligible to be entered in the Shorthorn Herd-Book was accepted with thanks.

Pens of Ewes.—Mr Howatson moved that each pen of ewes consist of one ewe instead of three as heretofore. After some discussion, it was agreed to postpone the matter for a year.

DAIRY DEPARTMENT.

On the recommendation of the Dairy Committee, it was agreed to ask the general meeting to make a grant of £100 for the promotion of dairy education in Scotland for the year 1894.

CHEMICAL DEPARTMENT.

Field Experiments.—It was agreed to carry out an experiment on the improvement of lea oats by means of the application of potash and lime manures along with sulphate of ammonia.

Analytical Associations.—The deficiencies reported in the quality of manures analysed for analytical associations were examined, and it was remitted to the Society's Chemist to make further inquiries as to five samples of manures and one sample of feeding-stuff.

Policy of the Chemical Department.—In view of the termination of the Society's experimental station at Pumpherston, and the passing of the Fertilisers and Feeding Stuffs Act, a Committee, consisting of the members of the Chemical Committee and four other members of the Board, was appointed to consider and report as to the future policy of the Chemical Department of the Society.

FORESTRY CHAIR.

The SECRETARY reported that he had paid over to the University the sum of £631 received by the Society towards the endowment of a Chair of Forestry in Edinburgh University. The Convener of the Forestry Committee was empowered to arrange with gentlemen in the different counties to raise further subscriptions.

AGRICULTURAL AND FORESTRY EXAMINATIONS.

The date of the annual examinations was fixed for the 21st, 22d, and 23d of March.

MEETING OF DIRECTORS, 17TH JANUARY 1894.

Present.—Ordinary Directors—Mr Fisher, Jellyholm; Mr Wardlaw Ramsay of Whitehill; Hon. the Master of Polwarth; Mr Glendinning, Hatton Mains; Mr Ferguson, Pictstonhill; Mr M'Gibbon, Ardnacraig; Mr Elliot, Hollybush; Sir Robert Menzies, Bart.; Mr Paterson, Hill of Drip; Sir James H. Gibson-Craig, Bart.; Rev. John Gillespie, Mouswald; Mr Speir, Newton Farm; Mr Davidson, Saughton Mains; Mr Scott Dudgeon, Longnewton. *Extraordinary Directors*—Mr Hope, Eastbarns; Mr Glendinning, Newmains; Captain Clayhills Henderson, R.N.; Mr Buttar, Corston; Mr Macduff of Bonhard; Mr Martin of Auchendennan; Mr Howatson of Dornel; Mr Shirra Gibb, Boon. *Hon. Secretary*—Sir G. Graham Montgomery, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Home Cook, C.A. *Engineer*—Mr J. D. Park. Sir James H. Gibson-Craig in the chair.

The business referred to the adjustment of the prize-list and regulations for the Aberdeen Show.

PROCEEDINGS AT GENERAL MEETINGS.

GENERAL MEETING, 14TH JUNE 1893.

MR FORBES of Culloden in the Chair.

CONGRATULATORY ADDRESSES ON THE MARRIAGE OF H.R.H. THE DUKE OF YORK.

"To her Most Gracious Majesty the Queen.

"MOST GRACIOUS SOVEREIGN,—We, your Majesty's faithful and loyal subjects, the Highland and Agricultural Society of Scotland, incorporated by royal charter, now assembled in General Meeting, feel it to be our most gratifying duty, on the occasion of the marriage of his Royal Highness the Duke of York to her Serene Highness the Princess Victoria Mary of Teck, to approach the Throne with the homage of our heartfelt congratulations, and to express the heartiness and unanimity with which we share in the universal rejoicings evoked throughout the British dominions by this singularly happy event. We again tender our devoted attachment to your sacred person and our loyalty to your Throne, and we pray that this union may be a lasting source of happiness and gratification to your Majesty, and that your Majesty's happy and prosperous reign, so pre-eminently blessed with good to mankind, may be prolonged for many years to come."

"To their Royal Highnesses the Prince and Princess of Wales.

"MAY IT PLEASE YOUR ROYAL HIGHNESSES,—We, the Highland and Agricultural Society of Scotland, incorporated by royal charter, in General Meeting assembled, desire to approach your Royal Highnesses to offer our heartiest congratulations upon the approaching marriage of his Royal Highness the Duke of York to her Serene Highness the Princess Victoria Mary of Teck. With the liveliest cordiality we share in the enthusiastic rejoicings which this happy event has evoked throughout the British empire, and we earnestly pray that the union, thus joyously welcomed, may be a lasting source of happiness and gratification to your Royal Highnesses and to the Duke of York and the Princess Victoria Mary. It has been observed with the most sincere satisfaction that, following the worthy examples of his illustrious father and grandfather, the Duke of York has evinced an active and genuine interest in the affairs of agriculture, and it is a matter of peculiar pleasure to us that an event so full of happiness to his Royal Highness has come to him during his presidency of our ancient Society."

"To his Royal Highness the Duke of York, K.G.

"MAY IT PLEASE YOUR ROYAL HIGHNESS,—We, the Highland and Agricultural Society of Scotland, incorporated by royal charter, in General Meeting assembled, beg to lay before your Royal Highness our sincere congratulations on the occasion of your marriage to her Serene Highness the Princess Victoria Mary of Teck, and to express the heartiness with which we join in the universal rejoicings this happy event has occasioned throughout the British empire. It is a matter of peculiar gratification and interest to us that this happy and auspicious event should have occurred during your Royal Highness' presidency of our ancient Society; and we earnestly pray that your

marriage with an English Princess, so warmly beloved by the people and so richly endowed with the gifts and graces of highest womanhood, may be a source of enduring domestic comfort and the truest happiness to yourselves, and prove a blessing to the great empire over which you will, we trust at a far distant date, be called to reign."

"To her Serene Highness Princess Victoria Mary of Teck.

"MAY IT PLEASE YOUR SERENE HIGHNESS,—We, the Highland and Agricultural Society of Scotland, incorporated by royal charter, in General Meeting assembled, desire to offer your Serene Highness our most hearty congratulations upon your approaching marriage to his Royal Highness the Duke of York. His Royal Highness having shown his sympathetic interest in agricultural affairs by accepting the presidency of this Society for the current year, we esteem it a peculiar pleasure to join with the heartiest enthusiasm in the universal rejoicing which this happy event has evoked. In common with British subjects in all countries, we greatly rejoice that his Royal Highness has been guided to the choice of a consort so eminently fitted for the exalted station to which his Royal Highness has been called, one who has already won the hearts of the people throughout the length and breadth of the land. We earnestly pray that the union may be a source of the purest and truest happiness throughout a long and prosperous lifetime."

EDINBURGH SHOW.

Sir JAMES H. GIBSON-CRAIG reported that the arrangements for the Edinburgh Show, to be held in the Dean Park on the 25th July and three following days, were now well advanced. Entries of implements had closed, and it would be found that the display in this important section of the Show was the largest in the history of the Society. Close on 6000 feet of shedding had been applied for. The entries for live stock will close at ordinary fees on Monday next, the 19th inst., and at late fees on Wednesday, the 21st. The prizes offered amounted in value to about £2600, and there was every reason to believe that the collection of live stock would be exceptionally large. It was evident that the three handsome champion cups offered by H.R.H. the Duke of York had aroused the keenest rivalry amongst stock-owners. The new permanent entrance gates for the showyard had been completed, and it was believed that their appearance would be satisfactory. The sum collected locally in support of the funds of the Show amounted to about £1100. This was considerably less than had been expected, and less than would be required to place the Society in as good a position as it was on the days of the voluntary assessment levied by the Commissioners of Supply. It was hoped, however, that a good many subscriptions would still be received.

Sir ROBERT MENZIES asked how much was collected in subscriptions at Inverness.

Sir JAMES said about the same as at Edinburgh.

Sir ROBERT. If Inverness can subscribe £1000, surely Edinburgh could do much more. (Laughter.)

ROTHAMSTED JUBILEE.

On the motion of the MASTER OF POLWARTH (in the absence of Mr Macpherson Grant), it was agreed to send the following congratulatory address to Sir John B. Lawes on the attainment of his jubilee as an agricultural experimenter:—

"*Congratulatory Address to Sir John Bennet Lawes, Bart.*

"SIR,—We, the members of the Highland and Agricultural Society of Scotland, in General Meeting assembled, embrace this opportunity of offering to you our heartiest congratulations upon the attainment of the jubilee of the splendid lifework in which you have been engaged at Rothamsted. Without parallel, either as to extent, character, or scientific and practical usefulness, the Rothamsted experiments have done more to advance agricultural science, and have been and will be of greater service to agriculture than can ever be fully realised. In these unique experiments, and in the munificent provisions you have made for their continuation, the nation has received an inheritance of inestimable value. In approaching you, therefore, with our congratulations upon the completion of half a century of your great work of scientific agricultural research, we would desire also to record our appreciation of the public spirit and benevolence which you have displayed in establishing and carrying on the Rothamsted experiments; to convey to you our high sense of personal regard for yourself; and to express our earnest hope that you may be long spared to enjoy in good health the quiet evening of a life that has been unusually active and abundantly fruitful in good work."

Agricultural Education.

The Rev. John Gillespie, Mouswald, reported that the annual examination of candidates for the Society's diploma and certificate was held on the 22d, 23d, and 24th March. The number of candidates who came forward was thirty-two, and the result was—two obtained the diploma and twelve the certificate, a result which he thought was not very satisfactory.

The Rev. John Gillespie also announced that the £10 given in prizes to the class of Agriculture in the University of Edinburgh had this year been awarded to—A. C. Welsh, Earlston, £4; Robert Affleck, Castle-Douglas, and Robert S. Daine, Woolfall, Heyton, Liverpool, £3 each.

Forestry Department.

Sir Robert Menzies reported that the forestry examinations were held on the same days as those for the agricultural diploma, when only one candidate came forward—viz., H. W. Tucker, Blackheath—and he was awarded a second-class certificate.

Sir Robert Menzies also reported that about £2000 had been collected for the endowment of a Forestry Chair in Edinburgh. That money they had invested, and with the approval of that meeting they proposed to pay the interest to Colonel Bailey, who was presently carrying on the Forestry class in the Edinburgh University.

Mr Fyshe, Treaton, said £50 was voted at last meeting for the support of the Forestry classes at Edinburgh. He observed that only one candidate came forward in the Forestry section at the last examination, and that that candidate only got a second-class certificate. He thought £50 was rather a high price to pay for a second-class certificate. (Applause.)

Sir Robert and others explained that good results could not be expected at once, and ultimately the report was unanimously adopted.

Chemical Department.

Dr Aitken gave in the following report on behalf of the Chemical Department:—

The grant of £200 per annum from the Board of Agriculture has enabled the Society to carry on its scheme of local experiments on a larger scale than heretofore. The centre of the Society's operations has this year shifted into Banffshire. The county has been divided into four representative districts, and secretaries resident in each district are in charge of the experiments being carried out on upwards of fifty farms. The subjects under investigation are the economical manuring of turnips and the improvement of pasture and of grass under rotation. The grass experiments have also been laid down in five other counties of Scotland on areas ranging from 2 to 4 acres each. A manurial experiment on the bean crop is being carried out on ten farms in the Stirlingshire district on areas of 1¼ acre each, and there are other experiments of a somewhat similar kind going on elsewhere. The manurial experiments at Pumpherston have all been carried out in good order and a month earlier than last year. The Chemical Committee are ready to consider applications from any county where experiments are desired, also to issue printed instructions for the guidance of those who are conducting them under the Society's regulations, and to supply manures and whatever else is requisite to ensure the obtaining of reliable results such as will be valuable to local agriculture.

Botanical Department.

Mr A. N. M'Alpine, B.Sc., the Society's Botanist, also reported upon this department. He had examined a large number of samples of grass and other seeds during the year, but had found nothing worth speaking of in the way of adulteration. Farmers should, however, continue to exercise great care in buying their seeds, and especially their grass-seeds, for these in the hands of unscrupulous dealers were always liable to be more or less adulterated.

Mr Gillespie then formally laid the 'Transactions' for the year on the table, and the meeting terminated.

GENERAL MEETING IN THE SHOWYARD AT EDINBURGH, 26th JULY 1893.

The customary General Meeting of the Society was held in the Pavilion at one o'clock, and was largely attended. Lord Polwarth, one of the Vice-Presidents,

occupied the chair, and among those present were Sir George Macpherson Grant; Sir James Gibson-Craig; Mr Forbes of Culloden; Captain Clayhills Henderson; Mr Maxwell of Munches; Colonel Stirling of Kippendavie; Mr Russell, Dundas Castle; Mr Johnstone Douglas of Comlongnan, Newcastle; Mr Wilken of Waterside; the Master of Polwarth; the Rev. John Gillespie, Mouswald; Mr Gideon Pott of Knowesouth; Mr Martin of Auchendennan; Mr Lumsden of Balmedie; Mr Paterson of Birthwood; Bailie Walcot, Edinburgh; Mr Ford, Fentonbarns; Mr Scott Dudgeon, Longnewton; Mr Buttar, Corston; and Mr G. R. Glendinning, Hatton Mains.

Lord POLWARTH, in opening the proceedings, read a letter of apology from his Grace the Duke of Buccleuch for his absence from the Show. Proceeding, his Lordship said he congratulated the Directors and the Society generally upon the success of that great Show. He was sure they must all feel that it promised to be in every way a success. Up to that time everything had gone on smoothly and well. The Show as a whole was excellent, and they were very much indebted to the gentlemen forming the Local Committee for all the trouble they had taken in making the arrangements. So far as they had seen, everything had been admirably arranged. They might congratulate themselves on the occasion of the Show being held in Edinburgh, and it was one which he hoped would rank amongst the most successful exhibitions they had ever had. He hoped it augured well for the future of agriculture in the country, and that they would return to their homes cheered and encouraged by that great exhibition.

VOTES OF THANKS.

Colonel STIRLING of Kippendavie moved that the thanks of the Society should be given to the Lord Provost, Magistrates, and Town Council of Edinburgh for their assistance and co-operation in furthering the success of the Show, and for the donation of 200 guineas voted by the Corporation in aid of the funds.

Mr FORBES of Culloden moved a vote of thanks to the subscribers to the fund for the Edinburgh Show.

Sir GEORGE MACPHERSON GRANT moved a vote of thanks to Sir James Gibson-Craig, the Convener, and to the other members of the Local Committee, for the assistance they had rendered in carrying out the arrangements.

Sir JAMES GIBSON-CRAIG moved a vote of thanks to his Royal Highness the Duke of York and to the other donors of special prizes for the liberal support they had given to the Show. They had heard how liberally the funds had been contributed for the general purposes of the Show; but many people, in addition to giving in that way, had assisted also by putting special prizes at the disposal of the Society. Outstanding among these special prizes were the cups given by his Royal Highness the Duke of York, which had imparted an immense impetus to the Show and a keenness to the contests which on former occasions had been wanting. The only regret was that their President had not been able to come down to the Show, as they had always hoped that he would. They knew, however, how it was that he had not been able to come, and they knew also, through his secretary, the deep regret he felt at being unable to do so. He trusted that it would not be long before they would have an opportunity of welcoming the Duke of York to the Society's showyard, if not in Edinburgh, then elsewhere.

The MASTER OF POLWARTH moved a vote of thanks to the railway companies for the facilities they had provided for the exhibitors and the public in connection with the Show. He had been informed by Mr Macdonald that the railway companies had taken a great deal of trouble in making the arrangements satisfactory in every respect.

Mr BUTTAR, Corston, moved a vote of thanks to the Rev. James Williamson, minister of Dean Parish, for conducting the services for the herdsmen in the pavilion on Sunday afternoon.

The votes of thanks were very cordially given.

THE SALE OF FERTILISERS.

Mr H. R. B. PEILE, Inverkip House (in the absence of Mr Sinclair Scott), proposed the following motion: "That as clause 6 of the Fertilisers and Feeding Stuffs Bill, now before the House of Commons, is opposed to the interests of agriculturists, the Society petition Parliament to either throw out or amend the said clause." In supporting the motion, he said he wished it to be distinctly understood that he had no desire to make any observations which might be taken exception to by honest traders, because he felt that it was in the interests of honest traders and their agricultural customers that the Fertilisers and Feeding Stuffs Bill should be one to put out of the field unscrupulous traders. He would read the first section in the bill, and they would see that the honest manufacturer was protected, because he had to give a statutory invoice naming the percentage of the ingredients of the manures sold to the

purchaser. He was also protected in so far as the words of the clause empowered him to give that percentage as nearly as he could. That, they all admitted, was fair to him, because they were all aware that when they had their manures analysed it could not be expected that the percentages would come out precisely as he had guaranteed them, and therefore the trifling variations were provided for in that clause, which was as follows: "Every person who sells for use as a fertiliser of the soil any article manufactured in the United Kingdom, or imported from abroad, shall give to the purchaser an invoice stating, as nearly as he can, the percentage of the nitrogen, soluble and insoluble phosphates, and potash, if any, contained in the article; and this invoice shall have effect as a warranty by the seller of the statements contained therein." He thought that was a fair and reasonable clause both for the honest trader and for his agricultural customer. Clause 6, to which his motion referred, was in the following terms: "Where any person is liable to pay compensation for deficiency of any ingredient in an article sold by him for use as a fertiliser of the soil, and proves that the buyer was not prejudiced by the variation from the invoice supplied with it, he shall be entitled to set off the value to the buyer of any excess of any other ingredient above the amount specified in the invoice." He wished that clause struck out of the bill entirely; and if they asked him to give any reason for that, he would quote from the 'Transactions of the Highland and Agricultural Society of 1892,' in which they had the report of the analytical associations. In that report it was said: "In all cases our guarantee extends to the minimum specified, and any excess of one fertilising ingredient is to be taken into account against a deficiency of another." That was in the manure merchant's bargain. The report went on: "This is a survival of the bad old guarantees against which the Committee have in former years warned the members of the Society. There is need to repeat the warning. The manurial experiments carried on under the Society's auspices in various parts of Scotland have shown that there is a certain ratio of manurial ingredients of ammonia to phosphates, which is found to be most appropriate for certain purposes, and to ask that a deficiency in the one should be balanced by an excess in the other is an absurdity."

The Rev. JOHN GILLESPIE seconded the motion. He said that in common with Mr Peile he regarded the question as one of the utmost importance. It appeared to him that there were two classes of persons to be protected. One was the farmer; the other was the fair and honest manure manufacturer or manufacturer and seller of cakes. These two classes were in the same boat in the matter, and it was for their common interest that the unscrupulous trader should be run out of the field. Mr Peile had shown one phase of the matter—the injustice which would on the merits ensue if the proposal in the bill was legalised. He (Mr Gillespie) would give them one familiar illustration. Supposing he went to a tailor and ordered a suit of clothes, and when they were delivered he found that the coat was too short, that the vest would not meet, and that the trousers were a great deal too long. It would be absolutely absurd that the tailor should be allowed to plead, and be legalised in pleading, that there was an equivalent in the length of the trousers for the shortness of the coat. (Laughter and applause.) There was about as much reason in the one proposal as in the other. (A voice, "No, no.") Well, he was willing to let other people have their opinion, but his view was that if he did not get the ingredient which he wanted to grow a particular crop, that was just about as bad as getting a vest that did not meet on him. Another aspect of the matter was, that if the bill was passed in its present form, it would be most fruitful of endless litigation.

Mr PATERSON of Birthwood suggested that Mr Gillespie's proposal should be added to the motion.

Mr CROSS, seedsman, said he thought that in the voting only those who had read the bill should hold up their hands. Those who had not read it should make a point of doing so before they voted for petitioning Parliament against it.

The motion, with Mr Gillespie's suggestion added to it, was then adopted.

This was all the business before the meeting.

ANNIVERSARY GENERAL MEETING, 17TH JANUARY 1894.

Colonel STIRLING of Kippendavie in the chair.

NEW MEMBERS.

The SECRETARY (Mr James Macdonald) submitted a list of new members, numbering in all 119. They were all duly elected.

OFFICE-BEARERS.

The SECRETARY intimated that the Committee recommended that the following noblemen and gentlemen should be elected to fill the vacancies in the list of office-bearers: *President*—His Royal Highness the Duke of York, K.G. *Vice-Presidents*—The Marquis of Huntly; the Earl of Strathmore; Sir Allan Mackenzie of Glenmuick, Bart.; John Gilmour of Montrave. *Ordinary Directors*—Alexander Cross of Knockdon; Captain Clayhills Henderson of Invergowrie, R.N.; W. T. Malcolm, Dunmore; Captain Robert Dundas, yr. of Arniston; George Cowe, Balhousie; James Lockhart, Mains of Airies; C. M. Cameron, Balnakyle; Hon. the Master of Polwarth. *Extraordinary Directors*—David Stewart, Lord Provost of Aberdeen; Bailie Mearns, Aberdeen; Morton Campbell, yr. of Stracathro; Garden A. Duff of Hatton; Thomas Gordon Duff of Drummuir; Fitzroy C. Fletcher of Letham Grange; David Buttar, Corston; William Duthie, Tarves; James Hay, Little Ythsie; George J. Walker, Portlethen; Andrew Mackenzie of Dalmore; Alex. Macduff of Bonhard; John M. Martin, Auchendennan; Charles Howatson of Glenbuck; R. Shirra Gibb, Boon; John Ballingall, Dunbog; Duncan Forbes of Culloden; David Wilson, yr. of Carbeth; Andrew Allan, North Kirkland; John Cran, Kirkton.

Mr FYSHE, Treaton, Fife, asked upon what principle these Extraordinary Directors were appointed. He noticed that some gentlemen came up there year after year as Extraordinary Directors, while at the same time they had never been elected representatives of any district. There were some gentlemen there who had not been elected to the directorate, and they had been on the Board year after year.

Sir JAMES GIBSON-CRAIG said he thought the gentleman who had just spoken must be labouring under some mistake with regard to the subject. He had better have referred to the by-laws, and he would find that the Directors of the Society were empowered to elect twenty Extraordinary Directors annually, ten of whom should be resident in the district in which the Show was held, and the other ten should be selected because of their known interest in the Society, and five of them must be tenant-farmers. These were the conditions under which Extraordinary Directors were elected, and the rule had been scrupulously adhered to. No gentleman had been elected as one of these ten Directors unless he had been already elected as an Ordinary Director, and shown his fitness for such an honour.

Mr FYSHE, Treaton, expressed his indebtedness to Sir James Gibson-Craig for the reply he had given. There were, however, two gentlemen who had been on the Board for twenty years, except four.

Sir JAMES GIBSON-CRAIG said the best plan for Mr Fyshe to go upon would be to take exception to the election of the gentlemen he referred to.

Mr FYSHE said there were two names he objected to—Mr Martin of Auchendennan and Mr Howatson of Glenbuck. They had been on the directorate for twenty years, with the exception of four years. No doubt they had shown a great interest in the Society, but he desired an explanation on the point.

The CHAIRMAN asked what explanation he required beyond what had been stated. The best procedure to follow would be that if Mr Fyshe had any objection to what had been stated by Sir James Gibson-Craig, he would better move an amendment.

The Rev. JOHN GILLESPIE, Mouswald, said the gentleman who had spoken seemed to think that the Extraordinary Directors remained there for ever. Surely he must think life was very short. The plan was that the Extraordinary Directors served three or four years—generally four years—and then they moved gradually up the list. Eventually they retired, but it was open to the Board to consider if it desired to re-elect them. The two gentlemen referred to were treated in exactly the same way as were the other Extraordinary Directors. They had served as Ordinary Directors and they had served as Extraordinary Directors, but they were treated just in the same way as were the other members of the Board. They had not served continuously as Extraordinary Directors, as had been stated by Mr Fyshe. They had been both Vice-Presidents and Extraordinary Directors. There was on the list the name of one gentleman who had not served as an Ordinary Director—namely, that of Mr Wilson, younger of Carbeth. He had been selected because of the valuable services he had rendered on an important Committee of the Society.

Mr Robert MacLellan, Glasgow, asked if any of the gentlemen had been elected in terms of the by-law brought before the meeting of 17th June, because if that was the case the by-law had not been confirmed in the ordinary way.

Sir James Gibson-Craig said that the names that had been mentioned by Mr Fyshe were very unfortunate examples, as it would be difficult to find other two men in the Society who had done more work for it.

Mr MacLellan again put his question about the by-laws, and was in the act of moving an amendment, when

The Chairman told him he was out of order. He asked Mr Fyshe if he had any amendment to propose.

Mr Fyshe said he had no fault to find with the two gentlemen whose names he had mentioned, but he held that there were others who took as great an interest in the work of the Society as them, and he failed to see why their names should be kept back so long. He did not wish, however, to move any amendment.

Mr MacLellan moved that, as the by-laws of 17th June had not been confirmed by a general meeting of the Society, the nominations from Dumfries and Kelso districts be not confirmed.

The Rev. John Gillespie said that the only competent motion to bring forward was that a gentleman might substitute one name for another.

The Chairman, replying to Mr Fyshe, Newtonlees, Dunbar, said that the names which they had heard read over were submitted to the Board by the Directors in terms of the Charter of the Society.

Mr MacLellan again proposed his amendment bearing on the by-laws and the nominations for the Dumfries and Kelso districts.

Sir James Gibson-Craig submitted that Mr MacLellan's amendment was quite out out of order.

The Chairman concurred in this view, and the office-bearers were agreed to as submitted to the meeting by the Secretary.

The Society's Finances.

Mr James Auldjo Jamieson, W.S., Convener of the Finance Committee, laid on the table the accounts for the year 1892-93. He said that the past year was the best, from a financial point of view, which the Society had had for sixteen years. The income for 1893 exceeded the expenditure by £3580. This balance of income arose mainly from the handsome profit from the Edinburgh Show, but it was also largely contributed to by a saving in the establishment expenses, and by the very large increase in the membership of the Society which took place last year. The number of new members elected in 1893 was the largest in any one year in the history of the Society. From this source alone the income of the Society last year exceeded that of 1892 by upwards of £500.

Argyll Naval Fund.

Captain Clayhills Henderson submitted the accounts of the Argyll Naval Fund for 1892-93, which showed that the income for the year amounted to £237, 7s. 3d., from which five recipients received each an allowance of £40, making the total expenditure £200. Two vacancies had recently occurred in the list of recipients, by the promotions of Mr Colin Mackenzie and Mr Godfrey George Webster, and that day the following had been appointed to the two vacant grants—viz.: Mr Colin Kenneth Maclean, midshipman on board the flagship Raleigh at the Cape, and Mr Leslie Menzies, serving in H.M.S. Blake, the flagship on the North American and West Indian Station.

The report was adopted.

Edinburgh Show, 1893.

Sir James Gibson-Craig, Convener of the General Shows Committee, in submitting the report on the Edinburgh Show of 1893, referred to the general regret which was caused by the inability of His Royal Highness the Duke of York to visit the Show. In all other respects the Show had been a marked success. The collection of implements and machines was the largest, and perhaps the best, in the history of the Society. The display of live stock was not quite so large as at the Centenary Show in 1884, but in point of merit it had not often been equalled. Delightful weather favoured the meeting, and the attendance of the public was very large. The financial results were highly satisfactory, showing, as they did, a net profit of about £2323. This exceeded the profit on the Centenary Show by nearly £500; and when it was remembered that the local subscriptions were £300 higher in 1884 than last year, it was found that the Show of last year was on its own footing quite £800 better than the great Centenary Show of the Society. Indeed, he might say that they were very

much better than was the case in 1884, when they had a two-shilling day on the Thursday. If they had had a two-shilling day on the Thursday at the last Show, instead of a one-shilling day, the increase would have been much greater. Though the local subscriptions were, as mentioned, less than the voluntary assessment in 1884, they were more liberal than at any other place since the present system came into force, and the thanks of the Society were specially due to the Town Council of Edinburgh, who raised their subscription from 100 to 200 guineas, and to Mr W. H. Cook, the Auditor of the Society, for his unremitting efforts in raising the fund. They had to go back to 1877 to have such a successful year as the last, and he hoped that as they had turned the corner they should pay their way in the future.

Mr Cowe, Balhousie, expressed his satisfaction with the report. He hoped now, seeing that they were on the right side, the Society would continue to progress in that direction. He had no remarks or criticism to offer, as he used to have in the past. He could assure them that no one was more pleased at the prosperity of the Society than he was.

The Rev. John Gillespie said there was another gentleman who should be referred to in connection with the success which attended the Edinburgh Show. It was natural, when Sir James Gibson-Craig referred to the Town Council of Edinburgh and Mr Cook, that he should omit his own name. He thought it would not be just if the Society did not acknowledge the zeal, and energy, and success which Sir James Gibson-Craig had displayed in raising subscriptions for the Edinburgh Show.

Mr Cowe thought that the best thing they could do was to return their sincere thanks to their new Secretary (Mr Macdonald) for his work during his first year of office.

The report was adopted.

Aberdeen Show—The Duke's Visit.

Sir James Gibson-Craig reported that the arrangements for their Show of this year, to be held at Aberdeen on the 24th of July, and three following days, were well advanced. He was sure it would be gratifying to the members of the Society, and to the people of Scotland generally, that His Royal Highness the Duke of York had been graciously pleased to accept of the presidency of the Society for another year. That gratification would be increased when it was learned that His Royal Highness had taken this step with the view of attending the Aberdeen Show next July in his official capacity. The good people of the North would therefore gain this year by the disappointment which was experienced in the South last year. The prize-list for the Aberdeen Show had just been revised by the Directors, and the first edition of it would be issued about the beginning of next month. Special prizes of not less than £10 in value might be accepted up till, but not later than, the 1st of March, when the list would be finally closed. The list of prizes would be found to be a specially liberal one. To meet the wishes of the Aberdeen district, the Directors had introduced classes for fat stock and draught geldings. A Local Committee had been appointed to raise subscriptions to the funds of the Show, and it was hoped their northern friends would see that the district gave a good account of itself in this respect. He might say that a very handsome example had been set by the Royal Northern Agricultural Society, who had voted £100 to the Show. Recognising the desirability of as far as possible increasing the privileges of members of the Society, the Directors have decided to provide a room in the showyard for the private use of members. The members' room would adjoin the rooms for the Directors and secretarial staff in the centre of the showyard, and its entrance would be off the main avenue. They were largely indebted to their new Secretary for making these arrangements, as he had had much experience of such matters in other places. They had, Sir James said, every reason to expect a most successful Show in Aberdeen. They intended to hold horse-shoeing competitions during the Show, and he hoped that other things of the kind would be brought forward.

Chemical Department.

Dr A. P. Aitken, the Chemist of the Society, submitted his annual report.

Experimental Station.—In the spring of 1887 the station at Pumpherston was sown out with a typical mixture of grass-seeds. The manures applied were the same as those used in former years, and they were applied as top-dressings for six years thereafter. The object of the experiment was to determine what were the specific effects of the various manurial constituents upon the growth of the various kind of grass and other plants grown on an ordinary meadow, both as regards quantity and quality. The sixth and last crop was cut in July, and a report upon the whole experiment is now being prepared for the 'Transactions.' With the permission of the new tenant additional observations will be made during the coming summer, but the main results of the experiment have now been obtained.

Local Experiments.—At the request of the Agricultural Society of Banffshire, a large number of experiments were carried out in the four divisions of that county, in order to show how most economically and efficaciously to raise a crop of turnips by means of artificial manures. The experiments were under the charge of four Local Committees, each acting under a secretary, and the results of upwards of thirty experiments have been sent in. These have already formed the subject of reports which have been published in the local newspapers, and a great amount of interest has been taken in the work.

During the month of August I visited most of the fields where the experiments were laid down, and in two of the districts I was accompanied by Mr Campbell of Jura, who was sent by the Board of Agriculture to inspect and report upon the experiments. We were both highly gratified with the careful and thorough manner in which the work had been carried out, and at the invitation of Mr George Bruce we met a large gathering of the Banffshire farmers, and discussed with them the results of the observations we had made. A communication has been received from the Secretary of the Central Banffshire Agricultural Association requesting that the experiments may be continued another year, and proposing further inquiries. A summary of these experiments, and also a number of experiments on the manuring of rotation grass in the county, will appear in the 'Transactions.'

In various parts of the country experiments have begun with the view of discovering how best to improve the character of pasture by increasing the growth of clover and the deeper-rooting grasses, and exterminating fog and superficial weeds. The Committee have prepared three separate schemes with that object in view, and are ready to supply the manures and printed schedules containing the instructions for their application, to members in any part of the country who apply for them. In Stirlingshire a series of experiments were carried out on the manuring of the bean crop, founded upon the information supplied by those made on that crop at Pumpherston. The extreme drought of last spring very much retarded the action of the manures, and a number of the members of the Stirlingshire Agricultural Society have requested us to repeat the test this year. Sets of manures are now being supplied for that purpose.

The Committee have also prepared a schedule describing an experiment on the manuring of lea oats, and copies will be issued to any agricultural societies who may apply for them.

The Committee has been asked to endeavour to discover some efficacious and cheap method of combating the finger-and-toe disease in turnips, and they would be glad to receive applications from any members who have land to be under turnips this year, and on which they expect finger-and-toe to make its appearance. Four substances to be tried upon a small scale, and instructions for applying them, will be sent forthwith.

Feeding Experiments.—Arrangements have been made with Mr Milne, Mains of Laithers, to whom the Society has in former years been indebted for the careful manner in which he has carried out feeding experiments on his farm, to try an experiment this year on the relative merits of linseed-cake on the one hand, and a mixture of decorticated cotton-cake and dried distillery grains on the other, so arranged as to produce a by-fodder having the same chemical analysis as linseed-cake. If it is found that the mixture is as efficacious as linseed-cake, the result will be a very great saving to feeders, for the mixture can be had at about two-thirds the price of the best linseed-cake. Should it be found that the feeding quality of the mixture is inferior to that of linseed-cake, we shall then have to inquire how it is that chemical analysis fails to show this difference, and endeavour to find some method of analysis that will be a truer test of feeding value.

Analytical Associations.—The number of samples for which the Society allows a grant in aid of the expense of analyses for the past year is 265. In no former year has this number been exceeded, and we may infer that the associations are still in a healthy vigorous condition. Out of all that number of purchases there are only six in which the stuffs supplied fall below their guarantees to the extent of one-tenth, and the circumstances of each case are being investigated by the Committee. In none of these are the differences serious, and they will probably admit of satisfactory explanation.

The great majority of the samples showed analysis above their guarantees, and for the most part they were bought at prices somewhat below their values as estimated from the Society's scale of units. This offers a striking contrast to the state of matters which existed in 1881, when the Society first came to the assistance of the associations, and for a few years thereafter. There is abundant evidence that the analytical associations, under the fostering care of the Society, have done a great work in Scotland, and have been of incalculable benefit to a very large section of the farming community.

The Fertilisers and Feeding Stuffs Act, which has now come into operation, confers upon farmers all over the country most of the advantages offered by the Society to

members of local analytical associations, and I can see in the provisions of the Act, and also in the regulations which the Board of Agriculture has issued for putting the Act in operation, that the Society's scheme and its regulations, which were submitted to the Departmental Committee appointed to take evidence regarding the bill, have received very careful consideration.

As soon as the Act passed, it became necessary for the Directors to consider how it affected the relation of the Society to the analytical associations, and as it was found that a large part of the benefits conferred on the members of the associations by the adoption of the Society's regulations were secured to them under the Act, and as the moneys which it had annually granted to provide analyses at a cheap rate were now required to be paid by county councils, it was their duty to do nothing that would interfere with the working of the Act, or relieve county councils of any part of their responsibilities. They therefore resolved to discontinue their present scheme; but, inasmuch as it was evident that county councils in many parts of the country would not be able to complete their arrangements for putting the Act in operation on the 1st of January 1894, when the Act took effect, they resolved to continue their scheme until the end of February, so that those whom they had hitherto assisted might not be put to inconvenience.

They are quite aware, however, that the benefits conferred by the Act fall far short in some important respects of those which the members of the associations derived from their own organisations under the Society's watchful care, and in view of that circumstance they resolved to continue the grant of £250 per annum, that it might be applied to whatever extent might be found expedient in protecting the interests of their members, and of analytical associations, in any manner in which the Act failed to do so, and in the promotion of any further scheme for the education and benefit of farmers in their purchases of fertilisers and feeding-stuffs. In order that such matters might receive the fullest consideration, a Committee of four Directors was appointed to co-operate with the Chemical Committee and assist them to shape the future policy of the Chemical Department.

Mr Fyshe, Newtonlees, desired to know if their present chemical arrangements were to be continued.

Mr George R. Glendinning said the matter was under the consideration of a Special Committee appointed for the purpose. After the Feeding Stuffs and Fertilisers Act was passed, the whole subject was taken into consideration, and the Directors had appointed a Special Committee to consider the entire question.

The report by Dr Aitken was approved of.

District Shows and Cottages and Gardens.

The Master of Polwarth submitted the report on district competitions and cottages and gardens, showing that, in 1893, 238 districts benefited by grants of money and medals, making a total award under this department of £305. For the current year the Directors proposed the following grants: Under section 1, seven districts for grants of £12 each for cattle, horses, and sheep, and seven districts in intermediate competition with a grant of three medals each. Under section 2, four districts for grants of £15 each for stallions. Under medals to local societies, twenty-four districts receive two medals each; for ploughing competitions, 180 medals are recommended. Under special grants, the Board recommend that £20 be given to the Kilmarnock Dairy Produce Show; £5 to the Shetland Agricultural Society; and £3 each to Orkney, South Uist, and North Uist. For cottages and gardens, two parishes at £3 each, and fourteen parishes at two medals each. For the erection and improvement of cottages, two gold medals, of the value of £10 each, are offered. The total sum proposed to be given in 1894 amounts to £275.

The meeting approved of the report.

A New By-law.

The Chairman said he had to move the following new by-law, which he hoped would meet with the unanimous approval of the meeting: "The Board shall have power to appoint one of its number to act as Chairman of the Board and of the deputation of Directors at the Annual Show, the said Chairman to retire at the end of the year, but if a member of the Board, to be eligible for re-election." Continuing, the Chairman said he supposed there was no one in that room who had not attended a very large number of shows, and he trusted that they were all convinced of the very great necessity of having a head to any Board. The object of this new by-law was to give them such a head as a Chairman. He thought it would strike them at once as a most important thing that they should have one individual to preside over all business matters. It was very often the case at show-time that the man who was in the chair one day

was not there the next day, and that was not so convenient as if they had one Chairman to carry out the whole business of the Show.

Mr J. HARLING TURNER, Portland Estates Office, Kilmarnock, seconded.

Mr COWE, who also seconded the motion, said they should be unanimous on this point. The best thing the Board could do was to put the best man at the head of affairs during show-time.

The by-law was adopted.

THE DAIRY DEPARTMENT.

The Rev. JOHN GILLESPIE reported that, on the recommendation of the Dairy Committee, the Directors resolved to ask the General Meeting to vote a sum of £100 for this year for the promotion of dairy education. Mr Gillespie said he ought to explain that the members of the Board were quite alive to the fact that they ought not to give any grant for dairy education that would relieve county councils from expending money that was given them for technical education. They believed that it was not the duty of the Society to spend money for that purpose when the county councils had plenty of money which they could devote to the purpose. There was at least one case in Scotland, and there might be more, where they could make out the claim that they had a dairy school. What was asked by the Board was that the meeting should give the power to spend this £100, and they would consider if it was necessary to spend all the money or not.

Mr FYSHE, Newtonlees, moved the previous question. It was said that a tremendous amount of capital was spent in the West. The same was the case in the East, but they did not come there to ask them for money. The farmers of the East country got no advantage from the Society, except what they got by the chemical analysis of their manures. He felt strongly on the point. The West country had bled the Society a great deal too much in recent years. They of the East were not beggars.

Mr HENDERSON, C.A., seconded Mr Gillespie's motion.

Mr W. S. FERGUSON, Pictstonhill, would not second Mr Fyshe, but he thought that gentleman was moving on the right lines. He did not see why this everlasting grant should go to the Kilmarnock Cheese Show.

Sir ROBERT MENZIES seconded the amendment.

The Rev. JOHN GILLESPIE, after a humorous allusion to the appearance of Mr Ferguson upon the scene, asked if it came to this, that the Highland and Agricultural Society was not to give encouragement to one thoroughly equipped dairy school in Scotland?

Mr FYSHE, Newtonlees, said they had no objection to the dairy school whatever, but let those who wanted it provide the money for it.

The Rev. JOHN GILLESPIE replied that the landlords in the West supported the school nobly. The Duke of Portland gave £50, the Duke of Buccleuch gave £50, the Earl of Eglinton gave £40, and the County Council of Ayr gave £200. It was surely important that the Highland and Agricultural Society should give some assistance in such an important work.

Mr FYSHE, Newtonlees, replied that the landlords were profiting by the school in that they got their farms let at high rents.

Dr GIBB of Boon said the objection to this grant came very badly at present. Mr Fyshe should have moved an amendment when his friend the Master of Polwarth submitted the report about district shows, and then he would have received his (the Doctor's) cordial support.

After some further discussion, Mr Gillespie's motion was carried by a large majority, eleven members supporting the amendment.

DIPLOMAS IN DAIRYING.

The Rev. JOHN GILLESPIE said he had given notice of the following motion: "That this meeting, recognising the urgent need which exists for diplomas and certificates in dairying being made available, regrets the delay in the adoption of the scheme prepared with this object by the Board of Agriculture, and resolves to forward a copy of this resolution to said Board, with a request that the subject may receive its prompt attention." Mr Gillespie said he did not think he need detain them by explaining or supporting this motion at any length. Dairy diplomas and certificates were clamantly needed in Scotland at the present time, but there was no body in Scotland that gave any such certificates. Those persons who qualified in Scotland to take such certificates or diplomas had to go away to the south of England and attend classes to make it possible for them to be examined. A good many cases had come to pass in which that expense and trouble had to be incurred. Some two or three years ago the Board of Agriculture asked the Highland and Agricultural Society, and a good many other agricultural bodies, to send representatives to London to confer with them in order to

draw up a scheme for conferring diplomas or certificates. The Society sent a representative, and he had reason to believe an admirable scheme was drawn up ready to be launched, but for some reason or other nothing more was done. The Board of Agriculture had neither gone forward nor gone backward. He did not blame the Board of Agriculture for this. It was against the will of the Board of Agriculture that the matter had been delayed. They were most anxious that something should be done, but there were difficulties in their way. He thought the time had come when they should call upon the Board of Agriculture to do something, or clear out of the way. If they could not get the Board to set up a scheme, he thought the Highland and Agricultural Society itself should formulate one.

Mr J. HARLING TURNER seconded, and remarked that the question involved in the proposal of Mr Gillespie was a most important one.

Mr COWE, Balhousie, did not think that it became the dignity of the Society to send such a motion to the Board of Agriculture, and he therefore moved the previous question. He pointed out, too, that Scotland had no representative on the Board of Agriculture as presently constituted.

Mr FYSHE, Treaton, seconded. He was of opinion that the matter should be allowed to rest until the Royal Commission inquiring into the state of agriculture had made its report.

Some further discussion followed, and the motion was carried by a large majority, four hands having been held up in support of the previous question.

THE FOREIGN MEAT BUSINESS.

Mr SCOTT DUDGEON, Longnewton, submitted the following motion for the approval of the meeting: "That this meeting expresses deep concern and indignation at the serious injustice done to the farmers of this country by the fraudulent sale of foreign meat in the form and name of British meat, and remits to the Directors of the Society to take whatever action they may consider most effective in obtaining a redress of this grievance." Speaking in support of the motion, Mr Scott Dudgeon said it would strengthen the Board in dealing with this matter if the General Meeting would fortify their hands by backing them up and giving them a direction as to how they were to deal with it. He thought it must be the opinion of every one interested in British agriculture that this matter of the fraudulent dealing in butcher-meat should in some way or other be put a stop to. No action had yet been taken by the Government to redress the grievance, and he thought the revelations that had been made were so extraordinary, every one must be satisfied that the evils to British agriculture from this cause could not be overstated. They could ask with great confidence that meat produced in this country should be sold as British meat, and that imported meat coming from other countries should be sold as imported meat. That was all they asked.

Mr PRENTICE, Strathore, seconded, and the motion was adopted unanimously.

THE FORESTRY CHAIR ENDOWMENT FUND.

Sir ROBERT MENZIES reported that the sum received by the Society towards the Forestry Chair Endowment Fund, amounting to £630, had been handed over to the University for investment for the benefit of the Lecturer on Forestry. He moved that the usual grant of £50 be continued this year. Mr PRENTICE seconded.

Mr FYSHE, Newtonlees, opposed the grant of £50, and moved the previous question, which was seconded by Mr COWE.

Dr CLEGHORN spoke in praise of the excellent character of the lectures delivered by Colonel Bailey, who had had great experience in various parts of the world, and the motion was carried by a large majority. Seven supported the amendment.

AGRICULTURAL EDUCATION.

The Rev. JOHN GILLESPIE stated that the examinations for the Society's diploma and certificate in agriculture would take place this year on the 21st, 22d, and 23d March, intending candidates requiring to lodge intimation with the Secretary on or before the 14th of March.

VETERINARY WORK.

The CHAIRMAN reported, on behalf of Major Wardlaw Ramsay, who had to leave the meeting, that, on the recommendation of the Veterinary Committee, it had been resolved to conduct further investigations as to the cause, prevention, and cure of "louping-ill," which continued to inflict serious losses upon flockowners. A sum of £50 had been voted for the investigations, which would be conducted during this year

by Professor Williams. There was good reason to believe that the results of these investigations would be of great practical benefit to owners of flocks.

The report was adopted.

Essays and Reports.

Rev. John Gillespie, Convener of the Publications Committee, reported that the following awards had been made for papers lodged in 1893—viz.: £10 for a paper on Dairy Management, by Mr John Hart, Cowie, Stonehaven; £5 for a paper on The Preservation of Soil Fertility in Plantations, by Mr A. C. Forbes, Bowwood, Calne, Hants. These papers would appear in the next volume of the 'Transactions,' for which an important series of papers on appropriate topics by well-qualified writers had been arranged.

Botanist's Report.

Mr M'Alpine submitted his report on the work of the Botanical Department. He said:—

I think it advisable in this report to say a few words regarding the clover and grass seeds in the market this season.

Clovers.—In England, red clover has been a very unequal crop, but some of it is very fine. English white clover is scarce, but good. English alsyke has been a fair crop. The crop of English trefoil has been almost a failure, and the usual price is almost trebled this season. American and Canadian red has yielded a large crop of fine vigorous seeds. American white has been a small crop. Canadian alsyke is grand, and the price moderate. German red has been a very short crop, and has yielded some good but high-priced seed. German white and alsyke are scarce. French red has been quite a failure on account of the drought, as also trefoil, hence the very high price of this seed.

Grasses.—The yield of Ayrshire perennial ryegrass is below the average, but the seed product is extra fine—26-28 lb. per bushel. Irish perennial has yielded a large crop of fine seed, but the prices are somewhat high, because all old stock was cleared out last year. Irish Italian has also yielded a good crop of fine seeds, but high in price. French or foreign Italian has been a very short crop, hence the high price. The crop of American timothy is under the average. American and New Zealand cock's-foots have yielded fair crops. Of the other grasses, crushed dog's-tail is about double the usual price.

Taken as a whole, the seeds in the market this season are extra large and fine, and accordingly calculated to yield large crops.

The meeting then dispersed.

APPENDIX.

PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND IN 1894.

CONTENTS.

GENERAL NOTICE.

THE HIGHLAND SOCIETY was instituted in the year 1784, and incorporated by Roya Charter in 1787. Its operation was at first limited to matters connected with the improvement of the Highlands of Scotland; but the supervision of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, several of the earlier objects contemplated by the Society were abandoned, while the progress of agriculture led to the adoption of others of a more general character. The exertions of the Society were thus early extended to the whole of Scotland, and have, for the greater part of a century, been directed to the promotion of the science and practice of agriculture in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter, in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The leading purposes of the Institution are set forth in the following pages, where it will be found that Premiums are offered for Reports on almost every subject connected with the cultivation of the soil; the rearing and feeding of stock; the management of the dairy; the improvement of agricultural machinery and implements; the growth of timber; the extension of cottage accommodation; the application of chemical science; and the dissemination of veterinary information.

Among the more important measures which have been effected by the Society are—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal towns of Scotland, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A system of District Shows instituted for the purpose of improving the breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement of Agricultural Education, under powers conferred by a supplementary Royal Charter, granted in 1856, and authorising "THE COUNCIL of the HIGHLAND AND AGRICULTURAL SOCIETY ON EDUCATION" to grant Diplomas to Students of Agriculture; and by the establishment of Bursaries. The Bursaries were discontinued in 1892.

4. The appointment of a chemist for the purpose of promoting the application of science to agriculture, and to superintend local experiments.

5. The advancement of the Veterinary Art, by conferring Certificates on Students who have passed through a prescribed curriculum, and who are found, by public examination, qualified to practice. Now terminated in accordance with arrangements with the Royal College of Veterinary Surgeons.

6. The establishment of a Botanical Department.

7. The establishment of a Dairy Department.

8. The appointment of a Board of Examiners, and the granting of First and Second Class Certificates in Forestry.

9. The annual publication of the 'Transactions,' which comprehend papers by selected writers, Prize Reports, and reports of experiments, also an abstract of the business at Board and General Meetings, and other communications.

10. The management of a fund left by John, 5th Duke of Argyll (the original President of the Society) to assist young natives of the Highlands who enter Her Majesty's Navy.

CONSTITUTION AND MANAGEMENT.

The general business of the HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of the Royal Charters, referred to above, which authorise the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Thirty-two Ordinary and Twenty Extraordinary Directors, a Treasurer, an Honorary and an Acting Secretary, an Auditor, and other Officers.

The Council on Education, under the Supplementary Charter, consists of Sixteen Members—Nine nominated by the Charter, and Seven elected by the Society. The Board of Examiners consists of Sixteen Members.

PRIVILEGES OF MEMBERS.

MEMBERS OF THE SOCIETY ARE ENTITLED—

1. *To receive on application a free copy of the 'Transactions' annually.*
2. *To apply for District Premiums that may be offered.*
3. *To report Ploughing Matches for Medals that may be offered.*
4. *To Free Admission to the Shows of the Society.*
5. *To exhibit Live Stock and Implements at reduced rates.**
6. *To have Manures and Feeding-Stuffs analysed at reduced fees.*
7. *To have Seeds tested at reduced fees.*
8. *To have Diseases affecting Farm Crops inquired into.*
9. *To attend and vote at General Meetings of the Society.*
10. *To vote for the Election of Directors, &c., &c.*

Analysis of Manures and Feeding-Stuffs.—The Fees of the Society's Chemist for Analyses made for Members of the Society shall, until further notice, be as follow:—

The estimation of *one* ingredient in a manure or feeding-stuff, ...	5s.
The estimation of *two or more* ingredients in a manure or feeding-stuff, . . .	10s.

These charges apply only to analyses made for the sole and private use of Members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.

If the sample represents a substance bought under a guarantee, and if it is found to be notably deficient, the Society will communicate with the vendor and endeavour to obtain compensation for the buyer.

The Society's Chemist also supplies valuations of manures, according to the Society's scale of units, in cases in which the cash price asked by the seller accompanies the sample.

Examining Seeds, Crop Diseases, &c.—The rates of charge for the examination of plants and seeds, crop diseases, &c., will be had on application to the Secretary.

Election of Members.—Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June. It is not necessary that the proposer should attend the Meeting.

Conditions of Membership.—The ordinary subscription is £1, 3s. 6d. annually, which may be redeemed by one payment, varying, according to the number of previous annual payments, from £7, 1s. to £12, 12s. Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land Stewards, Foresters, Agricultural Implement Makers, and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, are admitted on a subscription of 10s. annually, which may be redeemed by one payment, varying, according to the number of previous annual payments, from £3 to £5, 5s.† Subscriptions are payable on election, and afterwards annually in January.

Members are requested to send to the Secretary the names and addresses of Candidates they have to propose (stating whether the Candidates should be on the £1, 3s. 6d. or 10s. list).

Orders payable at the Royal Bank of Scotland, Edinburgh, are issued by the Directors, in name of the persons in whose favour Premiums have been awarded.

All communications must be addressed to "JAMES MACDONALD, Secretary of the Highland and Agricultural Society of Scotland, No. 3 George IV. Bridge, Edinburgh."

* Firms are not admitted as Members; but if one partner of a firm becomes a Member, the firm is allowed to exhibit at Members' rates.

† Candidates claiming to be on the 10s. list must state under which of the above designations they are entitled to be placed on it.

ESTABLISHMENT FOR 1894.

President.

HIS ROYAL HIGHNESS THE DUKE OF YORK, K.G.

Vice-Presidents.

The MARQUIS OF HUNTLY, Aboyne Castle, Aboyne, N.B.
The EARL OF STRATHMORE, Glamis Castle, Glamis, N.B.
Sir ALLAN R. MACKENZIE of Glenmuick, Bart., Ballater.
JOHN GILMOUR of Montrave, Leven, Fife.

Ordinary Directors.

PATRICK STIRLING of Kippendavie, Dunblane.
ROBERT ANDERSON of Lochdhu, Nairn.
GEORGE R. GLENDINNING, Hatton Mains, Wilkieston.
ALEXANDER M. GORDON of Newton, Insch, Aberdeenshire.
JOHN M. AITKEN, Norwood, Lockerbie.
W. S. FERGUSON, Pictstonhill, Perth.
DAVID M'GIBBON, Ardnacraig, Campbeltown.
WALTER ELLIOT, Hollybush, Galashiels.
R. SINCLAIR SCOTT, Burnside, Largs.
Sir ROBERT MENZIES of Menzies, Bart., Farleyer, Aberfeldy.
ROBERT PATERSON, Hill of Drip, Stirling.
Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., Currie.
JOHN MARR, Cairnbrogie, Old Meldrum.
Rev. JOHN GILLESPIE, Mouswald Manse, Ruthwell, R.S.O.
JONATHAN MIDDLETON, Clay of Allan, Fearn.
GIDEON POTT of Dod, Knowesouth, Jedburgh.
JOHN SPEIR, Newton Farm, Newton, Glasgow.
GEORGE DUN, Easter Kincaple, St Andrews.
Sir J. R. G. MAITLAND of Barnton, Bart., Craigend, Stirling.
JAMES I. DAVIDSON, Saughton Mains, Gorgie, Edinburgh.
W. H. LUMSDEN of Balmedie, Aberdeenshire.
ANDREW LUSK, Lochvale, Dumfries.
C. MACPHERSON GRANT of Drumduan, Forres.
JOHN SCOTT DUDGEON, Longnewton, St Boswells.
ALEXANDER CROSS of Knockdon, 19 Hope Street, Glasgow.
Captain CLAYHILLS HENDERSON of Invergowrie, R.N., Dundee.
W. T. MALCOLM, Dunmore Home Farm, Larbert.
Captain ROBERT DUNDAS, yr. of Arniston, Kirkhill, Gorebridge.
GEORGE COWE, Balhousie, Carnoustie.
JAMES LOCKHART, Mains of Airies, Stranraer.
C. M. CAMERON, Balnakyle, Munlochy.
The Hon. The MASTER OF POLWARTH, Humbie House, Upper Keith.

Extraordinary Directors.

DAVID STEWART of Banchory, Lord Provost of Aberdeen.
Bailie D. MEARNS, Quayside, Aberdeen.
MORTON CAMPBELL, yr. of Stracathro, Dun House, Montrose.
GARDEN A. DUFF, Hatton Castle, Turriff.

THOMAS GORDON DUFF of Drummuir, Keith.
FITZROY C. FLETCHER of Letham Grange, Arbroath.
DAVID BUTTAR, Corston, Coupar-Angus.
WILLIAM DUTHIE, Tarves, Aberdeenshire.
JAMES HAY, Little Ythsie, Tarves.
GEORGE J. WALKER, Hillside House, Portlethen, Aberdeen.
ANDREW MACKENZIE, Dalmore, Alness, N.B.
ALEXANDER MACDUFF of Bonhard, Perth.
JOHN M. MARTIN of Auchendennan, Alexandria, N.B.
CHARLES HOWATSON of Dornel, Glenbuck.
R. SHIRRA GIBB, Boon, Lauder.
JOHN BALLINGALL, Dunbog, Newburgh, Fife.
DUNCAN FORBES of Culloden, Inverness.
DAVID WILSON, yr. of Carbeth, Killearn.
ANDREW ALLAN, North Kirkland, Dalry, Ayrshire.
JOHN CRAN, Kirkton, Bunchrew, Inverness.

Office-Bearers.

Sir WILLIAM STUART WALKER, K.C.B., *Treasurer.*
Sir G. GRAHAM MONTGOMERY of Stanhope, Bart., *Honorary Secretary.*
JAMES MACDONALD, F.R.S.E., *Secretary.*
Rev. ARCHIBALD SCOTT, D.D., *Chaplain.*
ANDREW P. AITKEN, D.Sc., *Chemist.*
WILLIAM HOME COOK, C.A., *Auditor.*
TODS, MURRAY, & JAMIESON, W.S., *Law Agents.*
A. N. M'ALPINE, *Consulting Botanist.*
JAMES D. PARK, *Practical Engineer.*
JOHN MACDIARMID, *Clerk.*
EDWARD M. COWIE, *Second Clerk.*
WILLIAM WILLIAMS, F.R.C.V.S., *Professor of Veterinary Surgery.*
THOMAS WALLEY, M.R.C.V.S., *Professor of Cattle Pathology.*
WILLIAM BLACKWOOD & SONS, *Printers and Publishers.*
KEITH & Co., 65 George Street, *Advertising Agents.*
G. WATERSTON & SONS, *Stationers.*
JAMES CRICHTON & Co., *Silversmiths and Medallists.*
JOHN WATHERSTON & SONS, *Inspectors of Works.*
WILLIAM SIMPSON, *Messenger.*

Chairman of Board of Directors.

Sir JAMES H. GIBSON-CRAIG, Bart.

Chairmen of Committees.

1. *Argyll Naval Fund,* . .	Captain G. D. CLAYHILLS HENDERSON.
2. *Chemical and Botanical,* .	G. R. GLENDINNING, Hatton Mains.
3. *Dairy,*	ANDREW ALLAN, North Kirkland.
4. *District Shows, and Cottages and Gardens,*	The MASTER OF POLWARTH, Humbie House.
5. *Finance, Hall and Chambers, and Law,* . . .	JAMES AULDJO JAMIESON, W.S.
6. *Forestry and Highland Industries,*	Sir ROBERT MENZIES, Bart.
7. *General Shows,* . . .	Sir JAMES H. GIBSON-CRAIG, Bart.
8. *Machinery,*	JONATHAN MIDDLETON, Clay of Allan, Fearn.
9. *Publications, Ordnance Survey, and Reports of Meetings,*	Rev. JOHN GILLESPIE, Mouswald Manse.
10. *Veterinary,*	JOHN GILMOUR of Montrave.
11. *General Purposes,* . .	Sir JAMES H. GIBSON-CRAIG, Bart.

General Meetings.—By the Charter the Society must hold two General Meetings each year, and, under ordinary circumstances, they are held on the third Wednesday of the months of January and June, at one o'clock, in the Society's Hall, 3 George IV. Bridge, for the election of Members and other business. Twenty a quorum.

By a resolution of the General Meeting on 15th January 1879, a General Meeting of Members is held in the Showyard on the occasion of the Annual Show. This year it will be held at Aberdeen, on Wednesday, 25th July, an hour to be announced in the programme of the Show.

With reference to motions at General Meetings, Bye-Law No. 10 provides—"That at General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision unless notice thereof has been given a week previously to the Board of Directors, without prejudice, however, to the competency of making such motion or proposal to the effect of its being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting."

General Show at Aberdeen—24th, 25th, 26th, and 27th July.—Entries close for Implements, 21st May—Stock, Poultry, and Dairy Produce, 18th June.

Directors' Meetings.—The Board of Directors meet on the first Wednesday of each month from November till June inclusive, at *one* P.M., and occasionally as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Seven a quorum.

Nomination of Directors.—Meetings of Members, for the purpose of nominating Directors to represent the Show Districts on the Board, will be held at the places and on the days after mentioned:—

1. Glasgow, North British Station Hotel,	Wednesday, 1st Aug., at 1.
2. Perth, Salutation Hotel,	Friday, 3d August, at 2.
3. Stirling, Golden Lion Hotel,	Friday, 17th Aug., at 1.30.
4. Edinburgh, 3 George IV. Bridge,	Wednesday, 22d Aug., at 2.
5. Aberdeen, Imperial Hotel,	Friday, 24th Aug., at 12.
6. Dumfries, King's Arms Hotel,	Wednesday, 29th Aug., at 1.
7. Inverness, Caledonian Hotel,	Friday, 31st Aug., at 12.30.
8. Kelso, Secretary's Tent, Ram Sale Ground,	Friday, 7th Sept., at 1.

The nomination of Proprietors or other Members paying the higher subscription must be made in the 3d, 5th, 6th, and 7th Districts; and the nomination of Tenant-Farmers or other Members paying the lower subscription, in the 1st, 2d, 4th, and 8th Districts.

Committee Meetings.—Meetings of the various Committees are held as required.

Examinations for the Society's Diploma and Certificate in Agriculture and Certificates in Forestry are fixed to be held on the 21st, 22d, and 23d March.

COMMITTEES FOR 1894.

1. ARGYLL NAVAL FUND.

Captain G. D. Clayhills Henderson of Invergowrie, R.N., Dundee, *Convener.*
Sir David Baird of Newbyth, Bart., Prestonkirk.
Duncan Forbes of Culloden, Inverness.
Sir Robert Menzies of Menzies, Bart., Farleyer, Aberfeldy.
C. Macpherson Grant of Drumduan, Forres.

2. CHEMICAL AND BOTANICAL.

G. R. Glendinning, Hatton Mains, Wilkieston, *Convener.*
R. Shirra Gibb, Boon, Lauder, *Vice-Convener.*
The Master of Polwarth, Humbie House, Upper Keith.
John M. Aitken, Norwood, Lockerbie.
Prof. Bayley Balfour, Inverleith House.
David Buttar, Corston, Coupar-Angus.
Dr Cleghorn of Stravithy, St Andrews.
W. S. Ferguson, Pictstonhill, Perth.
George Henderson, Upper Keith.
Jonathan Middleton, Clay of Allan, Fearn, Ross-shire.
John Speir, Newton Farm, Newton, Glasgow.
David Wilson, yr. of Carbeth, Killearn.
Charles Howatson of Dornel, Glenbuck.
George Cowe, Balhousie, Carnoustie.
John Scott Dudgeon, Longnewton, St Boswells.
Dr Aitken, Chemist, *ex officio.*
A. N. M'Alpine, Botanist, *ex officio.*

3. DAIRY.

Andrew Allan, North Kirkland, Dalry, Ayr, *Convener.*
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.
James Lockhart, Mains of Airies, Stranraer.
Andrew Ralston, Glamis House, Forfar.
Robert Paterson, Hill of Drip, Stirling.
John M. Aitken, Norwood, Lockerbie.
Dr Aitken, Chemist, 8 Clyde Street, Edinburgh.
John Speir, Newton Farm, Newton, Glasgow.
Alexander Cross of Knockdon, 19 Hope Street, Glasgow.

4. DISTRICT SHOWS, AND COTTAGES AND GARDENS.

The Master of Polwarth, Humbie House, Upper Keith, *Convener.*
W. H. Lumsden of Balmedie, Aberdeen.
David Buttar, Corston, Coupar-Angus.
John Ballingall, Dunbog, Newburgh, Fife.
Walter Elliot, Hollybush, Galashiels.
Charles Howatson, House of Glenbuck, Glenbuck.

W. S. Ferguson, Pictstonhill, Perth.
James Lockhart, Mains of Airies, Stranraer.
George Dun, Easter Kincaple, St Andrews.
James J. Davidson, Saughton Mains, Gorgie, Edinburgh.
C. M. Cameron, Balnakyle, Munlochy.
Captain R. Dundas, yr. of Arniston, Gorebridge.
Andrew Allan, North Kirkland, Dalry, Ayr.
W. T. Malcolm, Dunmore Home Farm, Larbert.

5. FINANCE, HALL AND CHAMBERS, AND LAW.

James Auldjo Jamieson, W.S., 66 Queen Street, Edinburgh, *Convener.*
Sir James H. Gibson-Craig of Riccarton, Bart., *Vice-Convener.*
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.
Alex. Macduff of Bonhard, Perth.
Patrick Stirling of Kippendavie, Dunblane.
G. R. Glendinning, Hatton Mains, Wilkieston.
John Scott Dudgeon, Longnewton, St Boswells.
Sir William S. Walker, K.C.B., 5 Manor Place, *ex officio.*
Sir G. Graham Montgomery of Stanhope, Bart., Stobo Castle, *ex officio.*
William Home Cook, C.A., Auditor, *ex officio.*

6. FORESTRY AND HIGHLAND INDUSTRIES.

Sir Robert Menzies, Bart., Farleyer, Aberfeldy, *Convener.*
Sir Allan R. Mackenzie of Glenmuick, Bart., Ballater.
William Anderson Smith, Ledaig, Argyllshire.
Dr Cleghorn of Stravithy, St Andrews.
Duncan Forbes of Culloden, Inverness.
C. Macpherson Grant of Drumduan, Forres.
John Methven, 15 Princes Street, Edinburgh.
Col. F. Bailey, 7 Drummond Place, Edinburgh.
John Gilmour of Montrave, Leven.
Lewis Bayne, Jeanie Bank, Old Scone, Perth.
John Ord Mackenzie of Dolphinton, 9 Hill Street, Edinburgh.
C. M. Cameron, Balnakyle, Munlochy.

7. GENERAL SHOWS.

Sir James H. Gibson-Craig of Riccarton, Bart., Currie, *Convener.*
Sir Allan R. Mackenzie of Glenmuick, Bart., Ballater, *Vice-Convener.*
Sir Robert Menzies, Bart., Farleyer, Aberfeldy.
Patrick Stirling of Kippendavie, Dunblane.
David Buttar, Corston, Coupar-Angus.
John Cran, Kirkton, Bunchrew, Inverness.
Walter Elliot, Hollybush, Galashiels.
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.
John Gilmour of Montrave, Leven.
C. Macpherson Grant of Drumduan, Forres.
Charles Howatson, House of Glenbuck, Glenbuck.
W. H. Lumsden of Balmedie, Aberdeen.
Alex. Macduff of Bonhard, Perth.
Andrew Mackenzie, Dalmore, Alness.
John Marr, Cairnbrogie, Old Meldrum.
James Lockhart, Mains of Airies, Stranraer.
The Hon. The Master of Polwarth, Humbie House, Upper Keith.
Jonathan Middleton, Clay of Allan, Fearn.
John M. Martin of Auchendennan.
R. Sinclair Scott, Craigievar, Skelmorlie.
W. S. Ferguson, Pictstonhill, Perth.
George Dun, Easter Kincaple, St Andrews.

ALEX. M. GORDON of Newton, Insch, Aberdeenshire.
ALEX. CROSS of Knockdon, 19 Hope Street, Glasgow.
JAMES D. PARK, Engineer, *ex officio.*

8. MACHINERY.

JONATHAN MIDDLETON, Clay of Allan, Fearn, *Convener.*
JOHN SCOTT DUDGEON, Longnewton, St Boswells.
WALTER ELLIOT, Hollybush, Galashiels.
A. S. LOGAN, Ferney Castle, Reston.
JOHN MARSHALL, Maybole.
J. T. S. PATERSON, 55 Grange Loan, Edinburgh.
JOHN YOUNG, jun., Ayr.
R. SHIRRA GIBB, Boon, Lauder.
G. R. GLENDINNING, Hatton Mains, Wilkieston.
W. T. MALCOLM, Dunmore Home Farm, Larbert.
JAMES HAY, Little Ythsie, Tarves.
GEORGE J. WALKER, Hillside House, Portlethen.
GARDEN A. DUFF, Hatton Castle, Turriff.
JAMES D. PARK, Engineer, *ex officio.*

9. PUBLICATIONS, ORDNANCE SURVEY, AND REPORTS OF MEETINGS.

Rev. JOHN GILLESPIE, Mouswald Manse, Ruthwell, R.S.O., *Convener.*
Dr A. P. AITKEN, 8 Clyde Street, Edinburgh.
Dr CLEGHORN of Stravithy, St Andrews.
R. G. WARDLAW RAMSAY of Whitehill.
JOHN SCOTT DUDGEON, Longnewton, St Boswells.
J. M. AITKEN, Norwood, Lockerbie.
R. SHIRRA GIBB, Boon, Lauder.
JOHN SPEIR, Newton Farm, Newton, Glasgow.

10. VETERINARY.

JOHN GILMOUR of Montrave, Leven, *Convener.*
R. G. WARDLAW RAMSAY of Whitehill.
Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart.
WALTER ELLIOT, Hollybush, Galashiels.
G. R. GLENDINNING, Hatton Mains, Wilkieston.
ALEX. M. GORDON of Newton, Insch, Aberdeenshire.
ANDREW MACKENZIE, Dalmore, Alness.
PATRICK STIRLING of Kippendavie, Dunblane.
GEORGE J. WALKER, Portlethen, Aberdeen.
Hon. The MASTER OF POLWARTH, Humbie House, Upper Keith.
Professor WILLIAMS, *ex officio.*

11. GENERAL PURPOSES.

Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., Currie, *Convener.*
Hon. The MASTER OF POLWARTH, Humbie House, Upper Keith.
G. R. GLENDINNING, Hatton Mains, Wilkieston.
ALEX. M. GORDON of Newton, Insch, Aberdeenshire.
Rev. JOHN GILLESPIE, Mouswald Manse, Ruthwell, R.S.O.

The President, Vice-Presidents, the Treasurer, Honorary Secretary, and Chairman of Directors are members *ex officio* of all Committees.

AGRICULTURAL EDUCATION.

CERTIFICATE AND DIPLOMA IN AGRICULTURE.

COUNCIL ON EDUCATION.

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to grant Diplomas.

Members of Council named by Charter.

The PRESIDENT of the HIGHLAND AND AGRICULTURAL SOCIETY—*President.*
The LORD JUSTICE-GENERAL—*Vice-President.*

The LORD ADVOCATE.
The DEAN OF FACULTY.
The PROFESSOR OF AGRICULTURE.
The PROFESSOR OF ANATOMY.
The PROFESSOR OF BOTANY.
The PROFESSOR OF CHEMISTRY.
The PROFESSOR OF NATURAL HISTORY.

Members of Council nominated by Society.

The MASTER OF POLWARTH.
Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart.
R. G. WARDLAW RAMSAY of Whitehill.
W. J. MAXWELL, yr. of Munches, M.P., Terraughtie, Dumfries.
Rev. JOHN GILLESPIE, Mouswald, Ruthwell, R.S.O.
J. M. MARTIN of Auchendennan, Alexandria, N.B.
JOHN MARR, Cairnbrogie, Old Meldrum.

Board of Examiners.

1. *Science and Practice of Agriculture.*—Professor WALLACE, University, Edinburgh; JAMES HOPE, East Barns, Dunbar; JAS. BIGGAR, yr. of Chapelton, Dalbeattie; and Professor WRIGHT, Glasgow and West of Scotland Technical College, 38 Bath Street, Glasgow.
2. *Botany.*—Dr CLEGHORN of Stravithy, St Andrews, and A. N. M'ALPINE, Edinburgh.
3. *Chemistry.*—Dr A. P. AITKEN, Edinburgh, and Dr WILLIAM CRAIG, Edinburgh.
4. *Natural History.*—Professor COSSAR EWART, Edinburgh, and Dr RAMSAY H. TRAQUAIR, Edinburgh.
5. *Veterinary Science.*—Professor WILLIAMS, Edinburgh, and FINLAY DUN, F.R.C.V.S., Edinburgh.
6. *Field-Engineering.*—DAVID ALAN STEVENSON, C.E., Edinburgh, and A. W. BELFRAGE, C.E., Edinburgh.
7. *Book-keeping.*—WILLIAM HOME COOK, C.A., Edinburgh, and J. WILSON BRODIE, C.A., Edinburgh.

Standing Acting Committee.

The LORD JUSTICE-GENERAL—*Convener.*

The PROFESSOR OF AGRICULTURE.
The PROFESSOR OF BOTANY.
The PROFESSOR OF CHEMISTRY.
Rev. JOHN GILLESPIE of Mouswald.
R. G. WARDLAW RAMSAY of Whitehill.

BYE-LAWS.

I. That, in terms of the Charter, the Society shall nominate seven members to act on the Council on Education.

II. That the Council shall appoint a Board of Examiners on the following subjects :—Science and Practice of Agriculture ; Botany ; Chemistry ; Natural History ; Veterinary Science ; Field-Engineering ; and Book-keeping.

III. That the examinations shall be both written and oral, that the value of the answers shall be determined by numbers, and that the oral examinations shall be public.

IV. That there shall be two examinations,[1] to be styled respectively the "First-Class Certificate Examination" and the "Diploma Examination."

V. That to pass the "First-Class Certificate Examination," a candidate must be acquainted with the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping ; and that a certificate in the following terms, bearing the corporate seal and arms of the Society, signed by the President or Vice-President of the Council on Education, the Examiners, and by the Secretary, shall be granted to candidates passing this examination :—

"These are to certify that on the , A. B. was examined, and has been found to possess a knowledge of the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping."

VI. That to pass the "Diploma Examination," a candidate must possess a *thorough knowledge* of the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping ; and that a diploma in the following terms, bearing the corporate seal and arms of the Society, and signed by the President and Vice-President of the Council on Education, the Examiners, and by the Secretary, shall be granted to candidates passing this examination :—

"These are to certify that on the , A. B. was examined, and has been found to be proficient in the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping."

VII. That each successful candidate for the Society's Agricultural Diploma shall thereby become eligible to be elected a free life member of the Society.

VIII. That a Standing Acting Committee of the Council on Agricultural Education shall be appointed by the Directors.

Note.—The names of Diploma Free Life Members will be found in the list of Members of the Society.

The list of those who, up till 1892, had obtained the First-Class Certificate appears in vol. v., fifth series (1893), of the 'Transactions.' The following have since obtained

FIRST-CLASS CERTIFICATES.

1893 and 1894.

1893. E. M. Arnold, Sunningdale, Bexley Heath, Kent.
1893. G. Berry, Watermoor, Cirencester.
1893. R. S. Cunliffe, Edinburgh.
1893. E. Druce, Crewe.
1893. Arthur Shaw, Agricultural College, Aspatria.

[1] The examinations will be held in 1895 about the end of March.

1893. John A. Simpson, The Orchard, Banff.
1893. David L. Smith, Aspatria.
1893. G. R. Thomas, Aspatria.
1894. David Blair, Bankfoot, Inverkip.
1894. George Harley, Newcastle-under-Lyne.
1894. B. R. S. Prichard, Brislington, Bristol.

SYLLABUS OF EXAMINATION

FOR CERTIFICATES AND DIPLOMA.

I.—SCIENCE AND PRACTICE OF AGRICULTURE.

1. Geological strata—surface geology—formation of soils—their classification—chemical and physical characters and composition—suitability for cultivation. 2. The principle of rotations—rotations suitable for different soils—systems of farming. 3. The composition of (*a*) manures—general and special—amounts used per acre—period and mode of application. The composition of (*b*) feeding substances—their suitability for different classes of farm stock—considerations affecting their use. 4. "How crops grow"—our farm crops—their cultivation—diseases—insect injuries and remedies—their chemical composition. The formation and management of plantations. 5. The principles on which drainage, irrigation, and warping operations should be based and carried out. The application of lime—marl—clay, &c. 6. Meteorology, or the laws of climate as affecting plant-life—the influence of light and heat on cultivation—of absorption and retention of heat and moisture—of porosity and capillarity in soils. 7. The breeding, rearing, feeding, and general treatment of farm stock—the different breeds of horses, cattle, sheep, and pigs—their characteristics—the districts where they are generally met with. 8. The machines and implements used in farming—their uses, prices, and the principal points to be attended to in their construction. 9. The "prime movers," or sources of power used in agriculture: man—horse—wind—water—steam—their relative values and advantages. *Text-books*—Stephens' 'Book of the Farm,' William Blackwood & Sons, Edinburgh and London; Pringle's 'Live Stock of the Farm,' William Blackwood & Sons; Wallace's 'Farm Live Stock,' Oliver & Boyd; M'Connell's 'Agricultural Note-Book,' Crosby Lockwood & Son; 'Our Farm Crops,' Blackie & Son; 'How Crops Grow,' Macmillan & Co.; Warington's 'Chemistry of the Farm,' Vinton & Co., Limited, London; M'Alpine's 'Grasses'; Geikie's 'Outlines of Geology.'

II.—BOTANY.

1. Nutritive Organs of Plants.—Root, stem, leaves. Functions of roots. Various kinds of stem, with examples. Use of the stem. Structure of leaves. Different kinds of leaves. Arrangement and functions of leaves. 2. Reproductive Organs.—Flower and its parts. Arrangements of the whorls of the flower—calyx, corolla, stamens, pistil. Ovule. Mature pistil or fruit. Pruning and grafting. Seed. Young plant or embryo. Sprouting of the seed, or germination. 3. General Principles of Classification.—Meaning of the terms Class, Order, Genus, and Species. Illustrations of natural orders taken from plants used in agriculture, such as grain-crops, grasses, clovers, vetches, turnips, mangel-wurzel, peas, beans,

&c. Practical examination in fresh specimens and models; some of the latter may be seen in the Museum at the Royal Botanic Garden, which is open daily to the public, free. *Text-book*—Balfour's 'Elements of Botany,' A. & C. Black.

III.—CHEMISTRY.

The general principles of chemical combination. The chemistry of the more commonly occurring elements, and their more important compounds. The chemical processes concerned in agriculture generally. The changes which take place in the germination, growth, and maturation of plants, in the weathering and manuring of soils, &c. The composition and chemical character of the common mineral manures. *Text-books*—Roscoe's 'Lessons in Elementary Chemistry,' Macmillan & Co., London, price 4s. 6d.; Johnston and Cameron's 'Elements of Agricultural Chemistry and Geology,' William Blackwood & Sons; Johnston's 'How Crops Grow,' Macmillan & Co., London; Warington's 'Chemistry of the Farm,' Vinton & Co., Limited, London.

IV.—NATURAL HISTORY.

1. Zoology.

1. The characters distinguishing the primary divisions of the Animal Kingdom. 2. The Orders of the Class Insecta. 3. The principal insects injurious to crops. 4. The animal parasites, external and internal, affecting domestic animals; their life-histories and position in the zoological scale. 5. The Chordate or Vertebrate Type, with its subdivisions. 6. The Orders of Mammalia, with special reference to the domestic and wild mammalia of Great Britain. *Text-book*—Nicholson's 'Introductory Text-Book of Zoology,' William Blackwood & Sons, Edinburgh and London.

2. Geology.

7. The various strata forming the earth's crust in their order of deposition. 8. Their influence on the surface-soils of the country. 9. The meaning and application of Disintegration, Drift, Alluvium, Dip, Strike, Fault. *Text-books*—Page's 'Introductory Text-Book of Geology' and Lyell's 'Students' Elements of Geology.'

V.—VETERINARY SCIENCE.

1. Anatomy of the digestive organs of horse and ox, describing their structural differences. 2. The process of digestion in the above animals, and food most proper for each in quantity and quality. 3. The management of stock before, at, and after parturition. The time of utero-gestation in the domesticated animals. 4. The general principles to be followed in the treatment of acute and common diseases before assistance of the veterinary surgeon can be procured. *Text-books*—'Youatt on Sheep,' price 7s. 6d.; Steel's 'Diseases of the Ox,' price 15s.; Williams's 'Principles and Practice of Veterinary Surgery,' price 30s.; Williams's 'Principles and Practice of Veterinary Medicine,' price 30s.

VI.—FIELD-ENGINEERING.

1. Land-surveying with the chain. 2. Mensuration of areas of land, in imperial and Scotch acres, from a chain survey or from a plan. 3. Levelling with the ordinary levelling instrument and staff, and calculating

levels and gradients. *Text-book*—'Rudimentary Treatise on Land and Engineering Surveying,' by T. Baker, C.E., Weale's Series, price 2s. Part i. chaps. 1, 2, 3, and 6, and part ii. chap. 1, to be read.

VII.—BOOK-KEEPING.

1. Questions in Practice and Proportion. 2. Book-keeping—Describe books to be kept; give examples—taking of stock. *Text-book*—Stephens' Practical System of Farm Book-keeping,' William Blackwood & Sons, Edinburgh, price 2s. 6d.

EXAMINATION PAPERS, 1894.

AGRICULTURE.

1. Given a farm of 500 acres of good arable pasture and meadow land —100 acres of which are annually cut for hay, 100 acres lie in permanent pasture of good quality, and 300 acres are under a well-arranged system of rotation. In addition to a dairy of 50 cows (kept to a great extent on the "soiling" system, for the production of milk for sale), detail the stock of sheep, cattle, and horses you would select to consume the fodder grown on the farm. What kinds and quantities of food, home-grown and purchased, would be required for the different classes of animals? What produce would you expect to sell, and at what prices? and show what would be the financial position at the end of the year.

N.B.—It is necessary that you should state the rent, what rotation you follow, and what breeds of horses, cattle, and sheep you choose. The district in which the farm you select is located, as well as the distance from a town or railway station, should be mentioned.

2. Describe the best means of economising fodder on a mixed stock-farm after a period of extreme drought, such as prevailed in the southern counties of England during the early part of 1893.

3. Write a paper on the fertility of soils, pointing out in detail the nature and causes of any impoverishment produced by ordinary farming practice, and showing how land in pasture or under cultivation may be best maintained in high condition.

4. Describe the effects produced by lime on soils and on crops. State what quantities you would apply to (*a*) light sandy soil, (*b*) medium loam, (*c*) stiff clay, (*d*) newly reclaimed moss, (*e*) and to rough mountain pasture. Give reasons for your answers.

5. State suitable quantities of seed for the following crops, and name the district to which your scale applies: wheat, barley, oats, mangold, swedes, common turnips, potatoes; also a suitable mixture of grass seeds for (*a*) two years' grass, (*b*) permanent pasture.

6. I had 15 acres swedes, weighing about 24 tons per acre; I carted $\frac{1}{3}$ home for cattle, and valued them at 6s. per ton; I bought 200 shearling wedders at 32s. each—they consumed the remainder on the land in 14 weeks, when I sold them at 44s. each. I gave them artificial food at a cost of 3d. each per week, but I estimate the manurial residue of that is worth 1d. per week. How much per acre did I make for my turnip crop?

7. On an arable farm, one-half of which is a strong clay soil, while the other half is a sandy loam, and the whole farm is fully stocked with feeding cattle and sheep, what kinds and quantities per acre of artificial

manures would you apply to the clay and light land respectively for the following crops—1st, wheat; 2d, oats after lea; 3d, barley or oats after green crop; 4th, potatoes; 5th, turnips? If you decided to apply phosphates in the form of superphosphate of lime, and nitrogen in the form of nitrate of soda, would you mix them together before sowing? if not, state why. If you decided to apply phosphates in the form of slag, and nitrogen in the form of sulphate of ammonia, would you mix them together before sowing? If not, give the reason.

8. If you had a dairy-farm stocked with well-bred and well-fed Ayrshire or Shorthorn cows, state how many lb. of milk would you expect each cow to yield in the course of each milking season. If all the cream in each cow's milk were extracted by the separator or by setting, how many lb. of butter would you expect to have from each cow's milk? If the whole milk were used for cheese-making, how many lb. of cheese would you expect to have from each cow's milk? State whether your estimate applies to Ayrshire or Shorthorn cows. What is the average composition of milk?

(*Three hours allowed.*)

BOTANY.

1. State the chief differences between the roots of rye-grass, turnip, and onion.

2. State the botanical names and the Natural Orders to which the following plants belong: Prickly comfrey, mangel-wurzel, potato, and trefoil; also the special properties of these Natural Orders.

3. Describe the essential characters of the Graminaceæ and Cyperaceæ, and give two examples of each Order.

4. Give an example of a corm, a rhizome, and a bulb.

(*An hour and a half allowed.*)

CHEMISTRY.

1. Describe three oxides of lead.
   How is white lead prepared?
   How would you test for lead in a sample of drinking-water?

2. What is the composition of Condy's fluid?
   How is it prepared?
   How does it act as a disinfectant?

3. What are the three most important constituents in fodder? Describe the chemical properties of each.

4. Mention three substances that are known to prevent the loss of ammonia from farmyard manure, and explain the chemical action in each case.

5. What is the composition of green vitriol? How is it made? What is the action of heat upon it?

(*One and a half hour allowed.*)

NATURAL HISTORY.

Geology.

1. Give the general characters and chemical composition of *magnetite*, *calcite*, *gypsum*, *dolomite*, *fluorite*.

2. Explain the terms *joint*, *cleavage*, *false bedding*.

3. In what geological horizons is workable coal found in Great Britain? What theories have been propounded to account for the formation of coal-seams?

4. Explain the term *denudation*, and illustrate it by a diagrammatic section.

ZOOLOGY.

1. Enumerate, with examples, the orders of insects, and tabulate them according to the nature of their metamorphoses.

2. Describe the metamorphoses of a Frog. What salient differences are there between a *frog*, a *toad*, a *newt*, and a *lizard?*

3. Describe and contrast the dentition in the *porpoise*, *pig*, *ox*, and *dog*.

4. Give the distinguishing characters of the Ungulate mammals, and also of the subdivisions of Ungulata, with examples.

(*An hour and a half allowed.*)

VETERINARY SURGERY.

1. Name and briefly describe the several parts of the alimentary tract of the adult ox, detailing the changes which the solid food undergoes as it passes from the mouth onwards.

2. State the situations of the bony deposits which commonly cause lameness in horses.

3. Enumerate in the horse, cow, and dog the normal number of the heart-beats and of the respirations per minute, and the temperature. Mention several diseases in which the temperature exceeds, and several in which it falls below the normal.

4. Describe the nature, cause, and preventive treatment of liver-rot in sheep.

(*One and a half hour allowed.*)

MENSURATION AND FIELD-ENGINEERING.

NOTE.—Candidates must work out the questions on sheets of paper which will be supplied to them, which sheets must be signed by the candidates, and lodged, along with this examination paper, with the Secretary. The answers to the questions, excepting Nos. 4 and 7, are also to be filled in on this paper.

NOTE OF IMPERIAL MEASURE.

10,000	square links	=	1 square chain.			
625	do.	=	0·0625	do.	=	1 pole.
25,000	do.	=	2·5	do.	=	40 poles = 1 rood.
100,000	do.	=	10	do.	=	160 do. = 4 roods = 1 acre.

The imperial is to the Scotch acre as 1 : 1·261 nearly.

1. Calculate the area of the enclosure A in imperial acres, roods, and poles, and also in acres and decimals.

2. Calculate the area of the triangular enclosure A B C in imperial acres and decimals, and also calculate the length of the side A C to one place of decimals.

3. Measure by the scale the enclosure C, mark the measurements necessary to calculate the area from, in links on the paper, and calculate from them the area in imperial acres and decimals.

4. In the figure D, H E is an irregular boundary; F G a straight station-line; F H and E G perpendiculars to F G. Measure by the scale, and mark in links on the paper, the measurements required in order to survey the boundary H E.

5. Calculate from these measurements the area of the piece of land F H E G, in imperial acres and decimals.

6. The contents of a piece of land being 563 Scotch acres, required the area in imperial acres and decimals.

7. Write down, as if in a level-book, the staff-readings in feet and decimals shown in the above sketch section; then reduce the levels beginning at A, so as to calculate the heights of B, C, D, and E above datum-line,—all in feet and decimals.

8. Calculate the gradients of rates of inclination of the ground between the points A and B, B and C, C and D, and D and E.

$$\textit{Answer} \begin{cases} \text{A to B} = \\ \text{B to C} = \\ \text{C to D} = \\ \text{D to E} = \end{cases}$$

(*An hour and a half allowed.*)

ARITHMETIC AND BOOK-KEEPING.

1. (*a*) Bought 252 qrs. of wheat when the price was £4, 11s.; what quantity should I sell when the price is at 4 guineas to recoup myself?
(*b*) Divide ·8741685 by ·00785.

2. If 236 men eat 160 qrs. of wheat in 108 days, how many qrs. will 76 men eat in 1 year and 67 days?

3. In what time will 14 horses plough a piece of land which 30 mules can plough in 12 days, the work of 7 horses being equivalent to that of 10 mules?

4. Find by practice the price of 46 acres, 3 roods, 38 perches, at £2, 12s. per acre.

5. A father left his estate to his wife and three sons as follows—to his eldest son $\frac{1}{2}$ – £140, to his second son $\frac{1}{4}$ + £20, to his youngest son $\frac{1}{3}$ – £220, and to his wife $\frac{1}{5}$; find his estate and the share of each.

6. A bankrupt owed to his three creditors £48, 15s., £72, 10s., and £84, 13s. 4d. His effects amounted to £100; divide it among his creditors according to their claims.

7. Name the business books a farmer should keep in order to exhibit a correct state of his affairs at any time, and show the following transactions as the same should be recorded:—

Aug. 1. Sold at public sale 16 stots at £15, 10s.
" " Charges on above sale, £1, 13s. 1d.
" 3. Paid into Union Bank, £87, 6s. 2d.
" 8. Sold 120 B.F. hoggs to Adam Brown at 26s. 6d. each nett.
" " Charges, £2, 7s. 6d.
" 9. Paid to account of rent, £250.
" 11. Paid James Greig, carpenter, account for work done, £2, 12s. 6d.
" 12. Bought from Charles Davis a shorthorn bull at £25.

Aug. 13. Drawn from bank, £80.
" " Paid fixed servants' wages, £95.
" 14. Sold James Todd 65 quarters barley at 30s., and took his bill at 2 months for the price, he paying me £2, 17s. 6d. to meet this discount.
" 15. Discounted above bill, and paid discount.
" " Paid J. Brown & Co. for seeds £54, 12s. 6d., and feeding-stuffs £48, 7s. 6d.—less $2\frac{1}{2}$ per cent discount.
" 24. Bought a horse-rake from J. Smith, and gave him a cheque on the Union Bank for £7, 6s. 2d.

The farmer, after closing his books for the year, finds that through an error in his cash-book, under date 11th August, he has debited James Greig instead of J. Smith with the sum of £2, 12s. 6d. Make the correcting entries.

Detail briefly the procedure in bringing the books to a balance, and how the profit or loss on any one year's working would be arrived at.

(*An hour and a half allowed.*)

VETERINARY DEPARTMENT.

The Society established a Veterinary Department in 1823, but by an arrangement made with the Royal College of Veterinary Surgeons, the Society's examination ceased in 1881. Holders of the Society's Veterinary Certificate are entitled to become Members of the Royal College of Veterinary Surgeons on payment of certain fees, without being required to undergo any further examination. The number of Students who have passed for the Society's Certificate is 1183.

In 1874, the Society resolved to vote annually eight silver medals for Class Competition to each of the two Veterinary Colleges in Edinburgh, and to the one in Glasgow.

FORESTRY DEPARTMENT.

The Society grants First and Second Class Certificates in Forestry.

Board of Examiners.

1. *Science of Forestry and Practical Management of Woods.*—Colonel Bailey, Lecturer on Forestry, Edinburgh University, 7 Drummond Place; Dr Somerville, Durham College of Science, Newcastle-on-Tyne; Lewis Bayne, Forester, Jeanie Bank, Old Scone, Perth; James Kay, Forester, Bute Estate, Rothesay; J. Grant Thomson, Grantown, Strathspey.
2. *Elements of Botany.*—Dr Cleghorn and Professor Bayley Balfour.
3. *Elements of Chemistry.*—Dr Wm. Craig and Dr A. P. Aitken, Edinburgh.
4. *Land and Timber Measuring and Surveying; Mechanics and Construction, as applied to Fencing, Drainage, Bridging, and Road-making.*—A. W. Belfrage, C.E., Edinburgh.
5. *Book-keeping and Accounts.*—Wm. Home Cook, C.A., Edinburgh.

Candidates must possess—1. A thorough acquaintance with the theory and practice of Forestry. 2. A general knowledge of the following branches of study, so far as these apply to Forestry: The Elements of Botany; Elementary Chemistry, especially as applied to Atmosphere, Water, Soil, and Vegetation; Land and Timber Measuring and Surveying; Mechanics and Construction, as applied to fencing, draining, bridging, and road-making; Implements of Forestry; Book-keeping and Accounts. The examinations are open to candidates of any age.

The following have obtained First-Class Certificates:—

George Young Wall, M.R.A.C., Durham,	1870
William Baillie, The Nurseries, Haddington,	1871
William Robertson, Forester's House, Lauder,	1871
Peter Loney, Marchmont, Duns,	1873
John M. Aitken, Norwood, Lockerbie,	1880
Richard Henderson, Portland Estates Office, Kilmarnock,	1880
A. H. Gibson, Kirkcaldy,	1882

Alex. Inglis, Greenlawdean, Greenlaw, . .	1882
Peter Reid, Port Ellen, Islay, ...	1884
John Hardie Wilson, D.Sc., F.R.S.E., St Andrews, .	1884
Cecil Henry Hooper, M.R.A.C., Highlands Farm, Swanley, Kent, ...	1886
William Somerville, B.Sc., Prof. of Agriculture and Forestry, Durham College, Newcastle-on-Tyne, .	1886
John Bardgett, 1 Gayfield Street, Edinburgh, .	1887
Wilfred James Fleet, Estate Office, Thurlow, Suffolk,	1888
Arthur Charles Forbes, Bowood, Calne, Hants, .	1888
A. J. Farquharson, Newtyle, Forfarshire, . .	1890
John C. Menzies, Bankhead, Duns, . . .	1891

The following have obtained Second-Class Certificates :—

John M'Ewen, Yellow Cottage, Killin, . . .	1880
Thomas Berwick, 56 North Street, St Andrews, .	1885
Donald C. Cameron Grant, Southleigh, Murrayfield, .	1886
John A. Sawyer, Horningsham, Warminster, Wilts, .	1891
H. W. Tucker, Blackheath, ...	1893
H. S. Daine, Woolfall Hall Farm, Huyton, Liverpool, .	1894
John Maugham, Jerwaulx Abbey, Bedale, . .	1894
Eric Arthur Nobbs, Edinburgh, . . .	1894
John James Simpson, The Gardens, Wortley, near Sheffield, ...	1894

SYLLABUS OF EXAMINATION.

I.—SCIENCE OF FORESTRY AND PRACTICAL MANAGEMENT OF WOODS.

1. Structure, formation, and ripening of Wood. Predisposing causes of decay. 2. Restoration of Wood-lands:—(1) Natural reproduction; (2) Artificial planting. 3. General management of plantations. Cropping by rotation. Trees recommended for different situations. 4. Season and methods of pruning, thinning, and felling. 5. Circumstances unfavourable to the growth of trees. 6. Mechanical appliances for conveying and converting timber. The different implements and tools used in planting, pruning, felling, barking, and working up timber-trees, or preparing them for sale. Construction of saw-mills. 7. Qualities and uses of chief indigenous timbers. 8. Management of nurseries. Seed-sowing. 9. Collection of forest produce. 10. Mammals, birds, and insects which are destructive to trees.

Books recommended.—'Theory and Practice of Horticulture,' Lindley; 'Arboriculture,' Grigor, 10s. 6d.; 'Sylviculture,' Bagneris, 5s.; 'Coniferæ,' Veitch; 'Injurious Insects,' Ormerod, 3s.; 'Timbers, and how to know them,' Hartig.

Candidates are also obliged to undergo a Practical Examination in Forestry.

II.—ELEMENTS OF BOTANY.

1. Nutritive Organs of Plants.—Root, stem, leaves. Functions of roots. Various kinds of stems, with examples. Use of the stem. Structure of

leaves. Different kinds of leaves. Arrangement and functions of leaves. 2. Reproductive Organs.—Flower and its parts. Arrangement of the whorls of the flower—calyx, corolla, stamens, pistil. Ovule. Mature pistil or fruit. Pruning and grafting. Seed. Young plant or embryo. Sprouting of the seed or germination. 3. General Principles of Classification.—Meaning of the terms Class, Order, Genus, Species. Illustrations taken from common forest trees and shrubs. Practical examination on fresh specimens and models. These may be seen in the Museum at the Royal Botanic Garden, which is open to the public. Candidates may consult Professor Balfour's 'Elements of Botany,' A. & C. Black, Edinburgh, 3s. 6d.; Oliver's 'Elementary Lessons in Botany,' London, 4s. 6d.

III.—CHEMISTRY.

Candidates are required to have an elementary knowledge of Chemistry, such as to enable them to classify the most commonly occurring elements and their most familiar compounds, and to describe their chief characters.

They will be examined more particularly on the following subjects:—

Atmosphere.—Its composition and physical properties,—the causes of changes in its temperature and pressure, and the measurement of these changes by means of the thermometer and barometer. The formation of rain and dew. Gases injurious to vegetation.

Water.—The effects of heat upon it; its movements, its solvent properties, the methods of regulating the supply of water by drainage and irrigation. The characteristics of rain-water, spring-water, and surface-water. The relations of water to the growth and health of plants, and to the climatic conditions of a district.

Soil.—The description and classification of soils, and their suitability to the growth of different descriptions of timber-trees. The composition of soils, with special reference to the constituents on which their fertility depends, or which are the cause of their sterility. The changes produced in the composition of soils by various physical operations, such as drainage, irrigation, mulching, removal of leaves, &c., and by liming, salting, and manuring.

Vegetation.—The influence of temperature, rainfall, altitude, aspect, and shelter upon the growth of trees. The conditions favourable to germination. The effects of light, heat, and ventilation upon the growth of trees.

Forest Products.—The preparation and chemical characters of charcoal, potashes, tar, and turpentine.

Preservation of Timber.—Creasoting, kyanising, &c.

Books recommended.—'First Principles of Agriculture,' Tanner (Macmillan & Co.); 'Physics Primer,' Balfour Stewart; 'Inorganic Chemistry,' by George Wilson (Chambers).

IV.—LAND AND TIMBER MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, BRIDGING, AND ROAD-MAKING.

1. The use of the level and measuring-chain. Measuring and mapping surface areas. 2. The measurement of solid bodies—as timber, stacked bark, fagots, &c., earthwork. 3. The different modes of fencing and enclosing plantations; their relative advantages, durability, cost of construction, and repairs. 4. The setting out and formation of roads for temporary or perma-

nent use. 5. The construction of bridges over streams and gullies; of gates or other entrances. Strachan's 'Agricultural Tables,' Oliver & Boyd, Edinburgh, price 2s. 6d.; or Horton's Tables.

V.—BOOK-KEEPING AND ACCOUNTS.

1. Questions in Practice and Proportion. 2. Book-keeping—describe books to be kept; give examples. Taking of stock.

EXAMINATION PAPERS, 1894.

PRACTICAL FORESTRY.

1. Describe the formation of plantations in exposed situations; state the species and sizes of plants that should be used; and the best season for planting.

2. State what you know about thinning plantations, and the benefits derived from the operation.

3. What are the advantages of home nurseries on large estates? and what is the best season for sowing the seeds of the various forest trees grown for profit in Scotland?

4. How would you fell a tree with saw and axe? What direction would be the best for its fall on steep ground, or during wind? How would you treat a heavy-crowned tree?

5. Give a brief account of the life-history of the Spruce-gall Aphis (*Chermes abietis*), the nature of the injury it causes, and the measures that should be adopted against it.

(*Two hours allowed.*)

BOTANY.

1. Describe the essentials for and the methods of propagation of plants by (1) cuttings, (2) layering, (3) budding.

2. If a young tree loses its leader through any cause, how can a new one be formed?

3. Write an account of the life of any fungus causing disease in a "hard-wood" tree such as the oak.

4. Describe the structure and mode of formation of a seed. Explain the uses of the several parts.

5. Give an account of the influence of light in the formation of wood in the stem of a tree.

(*An hour and a half allowed.*)

CHEMISTRY.

1. What are the metals of the alkalies, and what are their chief characteristics?

2. Name a few of the chief salts contained in soils that are soluble in water

3. What are the conditions requisite for the germination of seeds, and what are the chemical changes that occur in germination?

4. In what way is the climate of a district affected by the extensive removal of timber? Explain how.

5. What is the source of turpentine? What are its chemical characters? What are its chief uses?

(*One and a half hour allowed.*)

LAND AND TIMBER MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, DRAINAGE, BRIDGING, AND ROAD-MAKING.

1. What is required so as to be certain of the correct adjustment of a spirit-level for accurate sights?

2. Make form of level-book on separate paper, with four sights marked with imaginary lengths and remarks.

3. Make sketch section of same to imaginary scale, marking on total heights from datum with the imaginary lengths from starting-point.

4. Describe the different kinds of fences, and where suitable, keeping expense in view.

5. Draw sketch of best construction for wooden gate.

6. Draw sketch of wooden bridge of 30 feet span over ravine above burn.

7. Describe method of road-making of permanent character of 30 feet width.

(*Two hours allowed.*)

ARITHMETIC AND BOOK-KEEPING.

1. A log of wood, 14 feet 10 inches long, was sawed into 7 deals each 2 feet 11 inches broad; how many square feet did they contain?

2. (*a*) Reduce 7 cwt. 3 qrs. 14 lb. to the decimal of 15 cwt. (*b*) 8 men accomplished 30 yards of ditching in 12 days, working 8 hours per day; in what time will 12 men finish a ditch, supposing its whole length 60 yards, when they work only 6 hours per day?

3. Bought 236 feet of wood at 3s. 10d. per foot, and sold it at 3s. 5d. per foot; what did I lose on it?

4. How much timber is there in a log 3 feet 8 inches by 2 feet 11 inches and $37\frac{1}{4}$ feet long?

5. Divide £$78\frac{2}{5}$ among 4 men and 2 women, and give each of the women $\frac{1}{3}$ of a man's share.

6. Reduce $\frac{4}{11}$ of $7\frac{1}{3}$ of £4, 12s. 6d. to the fraction of £90, 3s. 9d., and express the result decimally.

7. Invested £6313, 2s. 6d. in the 3 per cents at $92\frac{1}{2}$, and sold out at 93; what difference will it make in my income to reinvest the proceeds in the 4 per cents at $97\frac{1}{2}$?

8. Describe briefly the books a forester ought to keep, and their nature and use.

(*An hour and a half allowed.*)

CHEMICAL DEPARTMENT.

Chemist to the Society—Dr A. P. AITKEN, Chemical Laboratory, 8 Clyde Street, Edinburgh.

The object of the Chemical Department is to promote the diffusion of a knowledge of Chemistry as applied to agriculture among the members of the Society, to carry out experiments for that purpose, to assist members who are engaged in making local experiments requiring the direction or services of a chemist, to direct members in regard to the use of manures and feeding-stuffs, to assist them to put the purchase of these substances under proper control, and in general to consider all matters coming under the Society's notice in connection with the Chemistry of Agriculture.

MEMBERS' PRIVILEGES IN RESPECT OF ANALYSES.

The fees of the Chemist for analyses made for members of the Society shall, until further notice, be as follows:—

The estimation of *one* ingredient in a manure or feeding-stuff, . 5s.
The estimation of *two* or *more* ingredients in do. . 10s.

These charges apply only to analyses made for agricultural purposes, and for the sole and private use of members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.

If the sample represents a substance bought under a guarantee, and if it is found to be notably deficient, the Chemical Committee shall take cognisance of such deficiency in the same manner as they do in the case of deficient manures and feeding-stuffs supplied to members of analytical associations, provided that the Society's regulations as regards sampling are carried out, and that the seller's guarantee accompanies the sample.

Also, that valuations of manures, according to the Society's scale of units, shall be supplied in all cases in which the cash price asked by the seller accompanies the sample.

MISCELLANEOUS.

Analysis of water[1] to determine purity, hardness, and fitness for domestic use	£1	0	0
Analysis of agricultural products—hay, grain, ensilage, roots, &c.	1	0	0
Analysis of soil, to determine fertility and recommendation of manurial treatment	2	0	0

Samples should be sent (carriage paid) to Dr A. P. Aitken, 8 Clyde Street, Edinburgh.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

MANURES.

Four or more bags should be selected for sampling. Each bag is to be emptied out separately on a clean floor, worked through with the spade, and one spadeful taken out and set aside. The four or more spadefuls thus set aside are to be mixed together until a uniform mixture is obtained. Of this mixture one spadeful is to be taken, spread on paper, and still more thoroughly mixed, any lumps which it may contain being broken down with the hand. Of this mixture two samples of about half a pound

[1] Bottles for water and instructions for sampling samples are sent from the laboratory on application.

each should be taken by the purchaser or his agent, in the presence of the seller or his agent or two witnesses (due notice having been given to the seller of the time and place of sampling), and these samples should be taken as quickly as possible, and put into bottles or tin cases to prevent loss of moisture, and having been labelled, should be sealed by the samplers—one or more samples to be retained by the purchaser, and one to be sent to the chemist for analysis.

FEEDING-STUFFS.

Samples of feeding compounds should be taken in a similar manner.

Samples of cake should be taken by selecting three cakes, breaking each across the middle, and from the broken part breaking off a segment across the entire breadth of the cake. The three segments thus obtained should be wrapped up and sealed by the samplers, and sent for analysis as in the case of manures, and three duplicate segments similarly sealed and labelled should be retained by the purchaser.

SOILS.

Dig a little trench about two feet deep, exposing the soil and subsoil. Cut from the side of this trench horizontal scrapings of the soil down to the top of the subsoil. Catch these on a clean board, and collect in this manner about one pound weight of soil taken from the whole surface of the section. Similar scrapings of subsoil immediately below should be taken and preserved separately. Five or six similarly drawn samples should be taken from different parts of the field, and kept separate while being sent to the chemist, that he may examine them individually before mixing in the laboratory.

VEGETABLE PRODUCTS.

Turnips, &c., 20 to 30 carefully selected as fair average bulbs.

Hay, straw, ensilage, &c., should be sampled from a thin section cut across the whole stack or silo, and carefully mixed about; about 2 lb. weight is required for analysis.

Grain should be sampled like manures.

DAIRY PRODUCE.

Milk.—Samples of milk from individual cows should be taken direct from the milk-pail. Average samples from a number of cows should be taken immediately after milking. Samples to be tested for adulteration should not be drawn from the bottom or taken from the top of standing milk, but they should be ladled from the vessel after the milk has been thoroughly mixed.

For most purposes a quart-bottle of milk is a large enough sample.

Butter and Cheese.—About quarter-pound samples are required.

WATERS.

Samples of water for analysis should not be put into ordinary wine bottles or stoneware jars stopped with corks, as these usually vitiate the samples. Clear glass Winchester quarts with glass stoppers should be used. Cases containing these, chemically cleaned, are forwarded from the laboratory on application.

Well-water should be allowed to run for some time before the sample is drawn. If the well is newly made, or if any cleaning or digging operations have been going on in it, the water will be impure, and it must be pumped daily for a week, so as to renew the water many times before a clean sample can be got.

Standing water from cisterns, tanks, ponds, &c., should be sampled by immersing the bottle entirely under the water, and holding it, neck upwards, about four inches below the surface.

Spring or stream water should be sampled in dry weather, by immersion, if possible; but if not deep enough for that purpose, a perfectly clean cup or glass should be used for transferring the water to the bottle.

When the bottle has been filled the stopper should be rinsed in the water before replacing.

Samples should be despatched to the laboratory *immediately* after being taken.

LOCAL ANALYTICAL ASSOCIATIONS.

I. With the view of encouraging, as well as regulating the conduct of, Local Analytical Associations, the Society has since 1881 contributed from its funds towards their expenses a sum not exceeding £250 annually. In view of the passing of the Fertilisers and Feeding Stuffs Act, 1893, which places upon County Councils the duty of repressing the fraudulent sale of manures and feeding-stuffs, it was decided, at a meeting of the Directors on the 6th of December 1893, to discontinue this grant after the 1st of March 1894. Until that date the scheme remained in force as follows :—

II. The amount of such contribution is to each association at the rate of 10s. for each full analysis, and 5s. for each partial analysis[1] of manure or feeding-stuff affected, or such proportion thereof as the above annual contribution may permit of. The pecuniary assistance thus offered is subject to the following conditions being complied with to the satisfaction of the Chemical Committee :—

1. That the rules of the association are submitted to and approved of by the Chemical Committee.
2. That it is a condition of participating in the grant that the association make analyses for members of the Highland and Agricultural Society, being farmers and not members of the local association, charging them the cost price to the association, less the amount recovered from the Society.
3. That the association is managed by a committee of practical farmers owning or occupying land in the district.
4. That the analyst employed is of acknowledged standing.
5. That the benefits of the grant apply only to analyses made for farmers, and that these subscribe towards the expenses of the association, subject to the exception in No. 2.
6. That each analysis represents at least one ton of bulk actually purchased and delivered to one or more members under guarantee, or at a specified price per unit of valuable ingredients.
7. That the analysis has been made from a sample drawn after delivery, in accordance with the published instructions of the Society, and that a sealed duplicate sample has been retained.
8. That all analyses are reported according to forms furnished by the Highland and Agricultural Society, and that valuations of manures, if any are made, are calculated on a uniform standard to be issued periodically by the Society, and at least once a-year.

III. (*a*) A general report regarding the analyses for which the Society has contributed payment is submitted to the general meeting in January, and full details concerning manures and feeding-stuffs whose analyses show any of the valuable constituents to be deficient to the extent of one-tenth of the amount guaranteed, or whose total deficiencies represent as much as one-tenth of the value of the manure or feeding-stuff, are published in the 'Transactions.'

(*b*) In the case of every analysis showing the deficiency above described,

[1] A partial analysis is one in which only one important constituent has been determined by the chemist or guaranteed by the seller.

the secretary of the association must obtain confirmation of the deficiency from the chemist. The deficiency having been confirmed, the duplicate sample must be forwarded to the Secretary of the Highland and Agricultural Society. A copy of the analysis must at once be sent to the seller, and any explanations received from him forwarded in due course to the Secretary of the Highland and Agricultural Society.

(*c*) Should the seller be dissatisfied with the results obtained by the analyst of the association, a further analysis may, at his option, be made from the duplicate sample by another analyst to be chosen by the Society, and at its cost if the further analysis exonerates the seller; if otherwise, at the seller's cost.

IV. The report of each analysis for which a grant is claimed must be sent to the Secretary of the Highland and Agricultural Society not later than one month after the 1st March 1894, written on a schedule issued by the Society, and accompanied by a form of guarantee (also issued by the Society), which must be filled up and signed by the seller.

The schedules and guarantee forms are supplied by the Secretary of the Society on application, and no grant is given for any analysis whose schedule and guarantee form are not accurately filled up.

The actual analytical reports of the association's analyst need not accompany the schedules, but must be forwarded if desired.

METHOD OF PROCEDURE TO BE FOLLOWED BY SECRETARIES AND MEMBERS OF ANALYTICAL ASSOCIATIONS APPLYING FOR GRANTS FROM THE HIGHLAND AND AGRICULTURAL SOCIETY.

1. When a member makes a purchase he must obtain from the seller an analytical guarantee, written and signed by the seller, upon a form supplied by the Society.

2. When the member receives delivery of the stuff bought, he must inform the seller of the time and place at which the samples are to be taken for analysis, so that he may have an opportunity of being present.

3. In sampling a manure or feeding-stuff the Society's printed instructions for sampling must be strictly complied with.

4. The sample (if it is to be analysed) must be sent to the chemist within a week of the date of sampling, so that any deficiency may be immediately detected.

5. The chemist must be asked to send in his report of analysis within a fortnight after receiving the sample.

6. When an analysis shows the sample to be deficient to such an extent as to require investigation by the Society, the association's chemist must be asked to verify the accuracy of his analysis, and report the matter within a week.

7. When a deficiency has been confirmed the secretary of the association must immediately inform the seller thereof, and draw his attention to the provisions of Regulation III.

8. At the same time the duplicate sample must be sent to the Secretary of the Highland and Agricultural Society, and along with it must be sent the schedule relating to the purchase, and also the guarantee form, both accurately filled up in every particular.

9. Any correspondence that may ensue with the seller or buyer must be forwarded to the Secretary of the Highland Society as soon as received, so that the Committee may be able to investigate the matter with full knowledge of all the details.

10. The schedules (accurately filled up) of all samples for which the

association claims a grant, along with the signed guarantees appertaining to them, must be sent to the Secretary of the Highland and Agricultural Society on or before 1st April 1894.

MANURES—THEIR COMPOSITION AND CHARACTERISTICS.

Nitrate of Soda.—A most valuable nitrogenous manure. Perfectly soluble, and immediately available for the nourishment of the plant. Feebly retained by the soil. Rapidly goes down to the subsoil. Benefits deeply-rooting plants. *When much nitrate of soda is frequently applied and unaccompanied by other manures, the soil becomes rapidly exhausted.*

Good samples contain 95 per cent or upwards of pure nitrate of soda, equivalent to about 19 per cent of ammonia.

Sulphate of Ammonia.—A more concentrated nitrogenous manure than the preceding. Perfectly soluble, but not so rapid in its action as nitrate of soda. It is somewhat firmly retained by the soil, and not so liable as nitrate of soda to be washed out by heavy rains. It is therefore more suitable than nitrate for wet districts.

Good samples contain 95 per cent or more of pure sulphate of ammonia, equivalent to from about 24½ to 25 per cent of ammonia.

Dried Blood.—A nitrogenous manure, which differs from the above in being insoluble. It must be decomposed in the soil before it yields up its nitrogen to the plant, and this it does only slowly. The nitrogen is in the form of albumen, and is capable of yielding from 12 to 16 per cent of ammonia.

Horn-dust—Keronikon.—An insoluble nitrogenous manure, capable of yielding 15 to 17 per cent of ammonia. Slower than dried blood. Its efficacy as a manure increases the more finely it is ground.

Horn, when in the form of chips or coarse shavings, decomposes extremely slowly, and is not suitable for application as a manure.

Shoddy or Wool-waste.—An insoluble nitrogenous material used by manure manufacturers as a source of ammonia in dissolved manures. It is capable of yielding from 5 to 14 per cent of ammonia. It is a useful manure when dissolved, but not otherwise.

Leather.—A very insoluble nitrogenous material, yielding about 9 per cent of ammonia, used by manure manufacturers after being melted and ground, but of little value until it has been dissolved.

Peruvian Guano.—A general manure formed of the excrements of fish-eating birds, and containing nitrogenous compounds, phosphates, and potash.

High-class Peruvian guano is rich in nitrogenous matter, a large proportion of which is soluble. As formerly imported, it was capable of yielding from 8 to 12 per cent ammonia, part of which was derived from ammonia salts, and part (less than 1 per cent) from nitrates. Phosphates were low, seldom exceeding 30 per cent, but from one-quarter to one-half of the phosphates were soluble. The amount of potash was usually from 3 to 5 per cent. Not now imported.

Low-class Peruvian guano, as now imported, is poor in nitrogenous matter, yielding only from 3 to 5 per cent ammonia. The phosphates are correspondingly high—viz., from 30 to 50 per cent—but the proportion of soluble phosphate is much smaller than in high-class Peruvian guano. Potash occurs to a very small extent, viz., about 1 to 3 per cent.

Low-class guanos are formed originally from high-class guanos, by the washing out of soluble constituents by rain, &c., and their composition varies greatly according to the amount of washing they have undergone.

Genuine Peruvian guano frequently contains a large proportion of stony insoluble matter. It ought to be riddled before purchasing.

Fortified Peruvian Guano,—also called by various names, such as *improved*, *equalised*, &c.—Such guanos are mixtures, with low-class Peruvian guano for a basis. Sulphate of ammonia is added, and perhaps also other nitrogenous matter, to bring them up to the guaranteed analysis, say from 8 to 10 per cent ammonia.

Dissolved Peruvian Guano.—This is usually Peruvian guano dissolved in sulphuric acid, and fortified with sulphate of ammonia so as to make a strong, active manure.

Ichaboe Guano.—A true guano, but of recent formation. It is very rich in nitrogenous matter, which yields from 10 to 16 per cent of ammonia, but a large part of the nitrogenous matter is in the form of feathers, which are insoluble and of low manurial value, otherwise it resembles high-class Peruvian guano. The total phosphates vary from 18 to 30 per cent, of which from a fourth to a half is usually soluble. There is seldom as much as 2 per cent potash present.

Fish Guano.—Derived from fish-curing yards, and consisting of the heads and offal of fish, dried and ground. Properly speaking, it is not a guano. The name guano is properly applied only to the dung of birds and some other animals.

High-class fish-guano contains nitrogenous matter, yielding from 10 to 12 per cent of ammonia, but it is in the form of insoluble albuminous compounds, which only slowly decompose and become available as plant-food. The phosphates range from 18 to 30 per cent, and are all insoluble.

Low-class fish-guanos are substances like the preceding, but containing less nitrogenous matter and more phosphates. They are simply fish-bone manures, with somewhat more ammonia and less phosphate than ordinary bone-meal, and having no real resemblance to a guano.

Fish-guanos are usually impregnated with fish-oil, which detracts from the value of the manure. The oil should not exceed 3 per cent.

Frey-Bentos Guano.—The dried and ground residue and *debris* of animals after the extraction of "Liebig's Extract." It is not a guano. There are various grades of this manure. One contains much bone matter, another a good deal of horn. They are slow manures. The best manure is derived from muscular fibre, yielding about 14 per cent ammonia and about 5 per cent phosphate. It is a strong nitrogenous manure, variously named.

Bone-meal.—Chiefly a phosphatic manure, but containing also nitrogenous matter. Phosphates range from 44 to 55 per cent, according to the purity of the bones, and are insoluble. The nitrogenous matter is capable of yielding from 4 to 5 per cent ammonia, and is also insoluble. The higher the phosphates the lower the ammonia, and *vice versa.* The finer ground it is the more speedy is its action.

Bone-dust.—A coarser ground bone than the preceding.

Crushed Bones.—Still coarser ground.

Steamed Bone Flour.—Bones which have been subjected to steam at high pressure for the extraction of glue or gelatine. The residue contains from 56 to 65 per cent phosphates, and from 1 to 2 per cent ammonia. It is white-coloured and friable, and can be crushed with the hand. It is able to be, and ought to be, ground to a fine flour.

Pure Dissolved Bones.—Bones dissolved in sulphuric acid. It contains usually less than 20 per cent soluble phosphate, about 10 to 20 per cent of insoluble phosphate, and yields about 3½ per cent ammonia. A large proportion of the insoluble phosphate may consist of "precipitated" phosphate, which is quite as useful as soluble phosphate.

Dissolved Bone Manures.—These are compound manures, consisting of any mixture of phosphatic and nitrogenous materials which can be dissolved, with some admixture of bone, so as to produce a manure containing from 15 to 30 per cent soluble phosphates, and from 1 to 3 per cent

ammonia. *Dissolved bone manures* frequently contain some bone material that has not been dissolved.

Superphosphates.—Phosphates dissolved with sulphuric acid. Their composition varies according to the richness of the phosphate from which they are made, and the extent to which they have been dissolved. If mixed with nitrate of soda, except in very small quantity, it causes loss from escape of nitrous fumes, which are injurious when breathed.

High-class superphosphates are made from phosphates containing a high percentage of phosphate of lime, and are very thoroughly dissolved. They should contain between 35 and 40 per cent soluble phosphate.

Low-class superphosphates usually contain 26 to 28 per cent soluble phosphate.

Mineral Phosphates exist in great variety, and contain very various proportions of phosphate of lime, viz., from 20 to 90 per cent. They are of use as manures only when they are ground to the finest flour.

Thomas-Slag, Basic Cinder, or Slag Phosphate Meal.—A substance obtained as a waste product in the dephosphorising of steel. It contains from 30 to 40 per cent phosphate of lime, and should be manufactured into a powder of extreme fineness, 80 per cent at least passing through No. 100 wire-cloth. It is more soluble and available for plant-food than ground mineral phosphates. It may be mixed with nitrate of soda, but *not with sulphate of ammonia*, because it contains caustic lime.

Compound Manures.—These are general manures containing nitrogenous matter, phosphates, and potash, and their value depends not only on the amounts of these constituents, but also on their fineness of division, their solubility, and the sources from which their ingredients are derived.

The general character of a few of the more common of these may be indicated thus:—

Turnip Compounds.—These usually contain from 25 to 35 per cent phosphates, of which the half or more is soluble, and nitrogenous matter, capable of yielding from 2 to 5 per cent of ammonia, and sometimes 1 or 2 per cent of potash.

Potato Compounds.—These are somewhat like the preceding, but contain usually less phosphate and a little more ammonia (from 4 to 8 per cent); sometimes they contain no pótash, but more frequently about 3 or 4 per cent is present, and in some instances twice as much.

Bean Compounds.—These may contain from 10 to 20 per cent phosphates, nitrogenous matter yielding from 2 to 4 per cent of ammonia, and usually a considerable proportion of potash, often as much as from 10 to 20 per cent.

Cereal Compounds.—These usually contain about 20 per cent phosphates, mostly soluble, and nitrogenous matter, partly as nitrates, yielding from 3 to 8 per cent ammonia, and they may also contain potash.

Grass Compounds.—These are somewhat like the preceding, but may contain less phosphates and more nitrogen, part of which is usually in the form of nitrate.

NOTES REGARDING MANURIAL CONSTITUENTS.

The three important constituents of purchased manures are phosphates, nitrogenous matter, and potash salts.

The phosphates are described in analytical reports as containing phosphoric acid equal to so much "phosphate of lime"; the nitrogenous matter as containing nitrogen equal to so much "ammonia"; the potash salts as containing so much anhydrous "potash."

1. PHOSPHATES.—The phosphates occurring in manures are known to chemists as ortho-phosphates, and they are of three kinds, which may be thus represented—

Lime, Lime, Lime } Phosphoric acid.	Lime, Lime, Water } Phosphoric acid.	Lime, Water, Water } Phosphoric acid.
Tricalcic phosphate.	*Dicalcic phosphate.*	*Monocalcic phosphate.*

Tricalcic phosphate is the natural phosphate occurring in bones and mineral phosphates. It is insoluble in water, and contains, when pure, about 46 per cent phosphoric acid.

Monocalcic phosphate is formed from tricalcic phosphate by dissolving it in acid, which takes away two-thirds of its lime, and replaces it with water. It is soluble in water, and contains, when pure, about 60 per cent phosphoric acid.

Dicalcic phosphate is intermediate between these two, and is formed by their union. This union occurs in the case of phosphates which have been treated with less acid than is required to dissolve them entirely—*e.g.*, in pure dissolved bones, and it is usually called *precipitated* or *reverted* phosphate. It contains, when pure, about 52 per cent phosphoric acid, is insoluble in water, but soluble in certain saline solutions, and is nearly as active manurially as monocalcic phosphate.

"Soluble phosphate" ought, strictly speaking, to mean monocalcic phosphate, but according to trade usage it does not. It means that amount of tricalcic phosphate which by means of acid has been converted into monocalcic phosphate, or in other words, the insoluble phosphate that has been rendered soluble. There is a certain advantage in expressing all kinds of phosphate in terms of their equivalent of tricalcic phosphate.

Phosphates of magnesia, of iron, and of alumina, when occurring in small proportion, are not usually estimated separately, but are reckoned as phosphate of lime.

2. NITROGEN occurs in manures mostly in three forms—Ammonia salts, nitrates, and albuminoid matter.

Ammonia sulphate (pure), contains 25¾ per cent ammonia.
Ammonium chloride (pure), „ 31¾ „ „
Nitrate of soda (pure), contains nitrogen equal to 20 per cent ammonia.
Albuminoid matter contains from 14 to 16 per cent nitrogen, equal to from 17 to 19 per cent ammonia, most of which sooner or later becomes available as plant-food.

3. POTASH occurs mostly in the form of soluble salts, and should be reckoned as anhydrous potash (K_2O).

Sulphate of potash (pure), contains potassium = 54 per cent anhydrous potash.

Muriate of potash (pure), contains potassium = fully 63 per cent anhydrous potash.

FEEDING STUFFS—THEIR COMPOSITION AND CHARACTERISTICS.

These are concentrated forms of fodder, whose value depends upon their *albuminoid matter*, *oil*, and *carbohydrates* (such as starch and sugar).

LINSEED (seed of *Linum usitatissimum*, Common Flax).—Bombay seed large and pale; Baltic seed smaller and dark brown, more liable to impurities than Bombay seed; should be crushed and plotted before

feeding. Useful in calf fodders, also for milk-giving, and in the last stage of masting. Quantity, 1 to 3 lb. per 1000 lb. L.W.

LINSEED-CAKE.—Much approved feeding cake; merits well known. Home-made cake usually softer and more oily than foreign. Very hard-pressed cake is low in oil, and not so easily eaten and digested. Linseed-cakes usually impure. Chief impurities, locust-beans added to give flavour and relish, rape-seed, less frequently chaff, and weed-seeds from badly screened seed. Should be broken to small pieces before feeding. Quantity, 2 to 6 lb. per 1000 lb. L.W.

RAPE-CAKE (seed of *Brassica napus* and *B. campestris*).—It has a greenish mottled appearance and a bitter taste, which renders it distasteful to cattle at first. Should be given in small quantity to begin with. Not suited for calves. When given to milch cows, the quantity should not exceed 2 or 3 lb. per head per day, or it will give a disagreeable taste to milk and butter. Sometimes very impure. A dangerous impurity is mustard-seed. May be detected by steeping in cold water for some hours, and noting smell of mustard. Danger may be avoided by steeping the ground cake in *boiling* water.

POPPY-CAKE (seed of *Papaver somniferum*).—Contains a savoury and easily digestible oil. May be fed to cattle in considerable quantity—5 to 8 lb. per head per day. More than 5 lb. per head per day to milch cows detracts from flavour of butter.

HEMP-CAKE (seed of *Cannabis sativa*).—Not much used for feeding. Not so digestible as the above, owing to abundance of woody fibre (25 per cent). Fed chiefly to horses and sheep. To milch cows not more than 1 lb. per head per day. Apt to grow mouldy in summer.

SUNFLOWER-CAKE (seed of *Helianthus annuus*).—Relished by stock, and well digested.

COTTON-CAKE (seed of *Gossypium hirsutum*, &c.). *Undecorticated.*—Best quality from Egyptian and Sea Island seed. Inferior qualities are woolly, and to be avoided. Husk has astringent properties, and is a good cure for *scour*. Should be ground to the size of linseed. Not very digestible, owing to abundance of woody fibre (28 per cent). Should be used freshly made, because liable to mould on keeping.

Decorticated—viz., cotton-cake deprived of the husk.—A very concentrated and powerful bye-fodder. Should be given with caution, crushed fine, and mixed with Indian corn, oats, or other farinaceous food. Large quantity is injurious, and may even be fatal. Very variable in composition. Frequently very hard pressed, and therefore indigestible. When freshly made, softly pressed, and of good quality, it is a valuable bye-fodder. Oil very bland and digestible; used to adulterate olive-oil.

SESAME-CAKE (seed of *Sesamum orientale*).—Seed imported from India. Excellent bye-fodder, easily digested, much relished by all kinds of stock. Favourable for milk-giving, and also for masting. Oil bland and digestible, and much in favour for making margarine.

RICE-MEAL (seed of *Oryza sativa*).—The meal is a bye-product obtained in preparing rice for the market. A very good, safe, and acceptable fodder, but less concentrated than ordinary oilcakes. Varies very much in quality, and frequently adulterated with meal derived from rice husks. Much relished by stock, and useful for milch cows as well as for fattening animals.

RYE-MEAL.—Is the bran of rye, and rather more concentrated than wheat bran. It is very good fodder for cattle and sheep, but not for horses.

PALM-KERNEL CAKE.—An excellent, palatable, and easily digested bye-fodder. Especially good for milch cows. Increases the proportion of fat in milk. Puts a finish upon fattening stock. When ground to

powder and most of the oil extracted, it is sold as *Palm-kernel meal*, a much relished and digestible bye-fodder. A useful addition to calf-meals.

EARTH-NUT CAKE.—The pressed seed of a leguminous plant (*Arachis hypogœa*). The most concentrated of all cakes, containing from 45 to 50 per cent albumen and 6 to 9 per cent of oil. It is very palatable and digestible. A nutritious fodder when given in moderation. Apt to be contaminated with hair, and liable to rot on keeping if badly made.

FLESH-MEAL.—Residue obtained in the manufacture of *Liebig's Extract of Beef*. A highly nitrogenous bye-fodder, most suitable for enriching a too farinaceous dietary, such as potatoes. Much used in that way as a swine fodder. Easily digested, and readily accepted by cattle.

FISH-MEAL.—Bye-product of fish-curing yards, made chiefly from the heads of cod and tusk. Resembling fish-guano in composition, but somewhat variable. Highly phosphatic, and therefore useful as a bye-fodder to young growing cattle. Ratio, from 1 to 3 lb. per head per day.

HERRING-MEAL.—A very oily fodder, useful as an adjunct to the dietary of milch cows. Quantity, 1 to 4 lb. per head per day.

LOCUST-BEANS—*Carob Bean*.—A sugary fodder, most palatable and acceptable to all kinds of stock. Used to mix with oilcakes and meals, so as to improve their flavour.

DRIED GRAINS.—The draff from distilleries and breweries dried so as to contain only about 10 per cent water. It is a first-class feeding-stuff if of good quality, but the qualities differ considerably.

THE COMPOSITION OF FEEDING STUFFS.

The following is the average composition of genuine cakes and meals in common use:—

	Albuminoids.	Oil.	Carbohydrates.
Linseed-cake	29	11	32
Rape-cake	31	10	30
Poppy-cake	35	10	22
Hemp-cake	30	8½	17
Sunflower-cake	33	9	27
Cotton-cake	28	7½	30
,, (decorticated)	44	15	20
Sesame-cake	37	13	21
Rice-meal	11	10	50
Paisley meal	15	9	60
Rye-meal	14.5	3½	60
Bran	13.5	3½	56
Palm-kernel cake	17	10	41
Palm-kernel meal	19	3½	44
Earth-nut cake (shelled)	47	7½	25
Flesh-meal	71	13	...
Fish-meal	50	4	...
Herring-meal	40	20	...
Locust-bean meal	4	2	74
Linseed	21	37	20
Dried grains	20	8	50

Useful Factors.

Amount of	Multiplied by	Gives corresponding amount of
Nitrogen	1.214	Ammonia.
"	6.3	Albuminoid matter.
Ammonia	.824	Nitrogen.
"	3.882	Sulphate of ammonia.
"	3.147	Muriate of ammonia.
"	3.706	Nitric acid.
"	5.0	Nitrate of soda.
Potash (anhydrous) . .	1.85	Sulphate of potash.
"	1.585	Muriate of potash.
Phosphoric acid (anhydrous) .	2.183	[1] Phosphate of lime.
" "	1.4	Biphosphate.
" "	1.648	[2] Soluble phosphate.
Soluble phosphate[2] . .	1.325	[1] Phosphate of lime.
Biphosphate	1.566	"
Lime	1.845	"
"	1.786	Carbonate of lime.
Chlorine	1.648	Chloride of sodium.

FORMS OF GUARANTEE.

Guarantee of Manure.

I guarantee that the manure called....................and sold by me to ....contains a minimum of—

Soluble phosphoric acid =Phosphate of lime dissolved ....per cent.
Insoluble phosphoric acid=Phosphate of lime undissolved.........per cent.
Potash salts . . =Potash (K_2O) . . . .per cent.
Total nitrogen . . =Ammonia . . . .per cent.

Signature of seller.......................

Date.................18...

Guarantee of Feeding Stuff.

I guarantee that the feeding-stuff called..............and sold by me to ....contains a minimum of—

.... per cent albuminoids.
.... per cent oil.
.... per cent carbohydrates.

Signature of seller.......................

Date.................18...

[1] Tricalcic ortho-phosphate ($3CaO, P_2O_5$).
[2] Monocalcic ortho-phosphate ($CaO, 2H_2O, P_2O_5$).

LOCAL ANALYTICAL ASSOCIATIONS WHO HAVE RECEIVED THE SOCIETY'S GRANTS.

	County.	Name of Association.	Name and Address of Secretary.	Number of Analyses.				Grants obtained.			
				1890.	1891.	1892.	1893.	1890.	1891.	1892.	1893.
1	Aberdeen . .	Alford Analytical Association .	C. M'Connach, Cairnballoch, Alford	18	15	14	16	£7 15 0	£6 0 0	£6 5 0	£7 15 0
2	" . .	Buchan Farmers' Analytical Association	Thomas Forrest, Mains of Ludquharn, Longside	11	7	7	10	4 10 0	2 10 0	2 15 0	4 5 0
3	" . .	Turiff Analytical Association .	James Beattie, Gordonstown, Rothienorman	16	26	14	18	6 15 0	10 15 0	6 15 0	8 10 0
4	Ayr . . .	Galston and Loudoun Farmers' Analytical Association	Alex. Goldie, Irvine Bank House, Darvel	3	3	3	3	1 10 0	1 10 0	1 10 0	1 10 0
5	" . . .	Grougar Farmers' Analytical Assoc.	R. Whyte, East Raws, Kilmarnock .	4	4	5	6	1 10 0	1 5 0	1 15 0	2 0 0
6	Argyll . .	Kintyre Farmers' Analytical Assoc.	R. Dickie, Kileonan, Campbeltown .	9	7	..	..	3 5 0	2 5 0	..	..
7	Caithness . .	Caithness Farmers' Analytical Asso.	G. Brown, Watten Mains, Caithness	..	..	..	..	..	..	..	..
8	Dumfries . .	Annandale Farmers' Club . .	J. & J. Baird and J. Mackenzie, Lockerbie	4	..	1	..	2 0 0	..	0 10 0	..
9	Elgin . . .	Morayshire Analytical Assoc. .	R. Barclay Gordon, 78 High St., Elgin	9	10	7	13	3 15 0	4 5 0	2 15 0	5 10 0
10	Forfar . . .	Arbroath Analytical Association .	James Kydd, Seryne, Carnoustie .	31	43	21	27	14 0 0	20 5 0	9 5 0	13 0 0
11	" . . .	Carse of Gowrie Farmers' Analytical Association	A. Anderson, Berryhill, Dundee .	11	7	8	29	5 5 0	3 5 0	3 15 0	13 0 0
12	" . . .	Kirriemuir Analytical Association	Andrew Osler, Kintyrie, Kirriemuir	4	9	..	..	1 10 0	3 15 0	..	..
13	Inverness . .	Inverness Farmers' Society . .	William Ross, Seafield of Raigmore, Inverness	..	..	..	..	..	..	..	..
14	Kincardine . .	Kincardineshire Farmers' Club .	A. B. Annandale, Stonehaven . .	..	..	..	..	..	..	..	..
15	Kirkcudbright .	Kirkcudbright Analytical Association	Patrick Gifford, King Street, Castle-Douglas	17	14	7	19	7 15 0	6 0 0	3 0 0	8 5 0
16	Lanark. . .	Lanarkshire Analytical Association	J. Lindsay, Eastfield, Thankerton .	19	18	14	10	6 15 0	6 5 0	4 10 0	3 10 0
17	" . . .	Avondale Farmers' Analytical Asso	John Paterson, Torfoot, Strathaven .	4	7	8	4	1 5 0	2 10 0	2 15 0	1 10 0
18	Nairn . . .	Nairnshire Analytical Association	J. S. Robertson, Cawdor Estate Office, Nairn	11	22	24	27	4 15 0	9 0 0	10 0 0	11 0 0
19	Orkney. . .	Orkney Agricultural Society .	Jas. Johnston, Orphir House, Orphir	..	..	..	..	..	..	..	..
20	Perth . . .	Strathearn Analytical Association	J. T. Smith, Eastfield, Bridge of Earn	2	7	16	12	1 0 0	3 0 0	6 10 0	4 10 0
21	Ross . . .	Easter Ross Analytical Association	T. Anderson, Ballachroggan, Alness	6	11	..	8	2 15 0	4 10 0	..	3 0 0
22	" . . .	Wester Ross Analytical Assoc. .	Walter Arras, Fodderty Lodge, Dingwall	14	30	33	33	5 0 0	11 15 0	12 0 0	12 0 0
23	Roxburgh . .	Kelso Analytical Association .	Alex. Pott Stevenson, Kelso . .	5	14	5	6	2 0 0	5 15 0	2 0 0	2 15 0
24	Wigtown . .	Stoneykirk Analytical Association	James Hunter, Culgroat, Stranraer .	10	13	10	9	4 5 0	5 0 0	4 0 0	3 10 0
				208	265	182	250	87 5 0	109 10 0	80 0 0	105 10 0

UNITS TO BE USED IN DETERMINING THE COMMERCIAL VALUE OF MANURES.[1]

Terms—CASH, including Bags gross weight—not including Carriage.

N.B.—These units are based on the present RETAIL PRICES at port. When these units are multiplied by the percentages in the analysis of a Manure, they will produce a value representing very nearly the cash price at which one SINGLE TON may be bought in fine sowable condition. Larger purchases may be made on more favourable terms.

For Season 1893.

Items to be Valued.	Guanos.		Scrap Manures.			Bone-Meal.		Steamed Bone Flour.	Dissolved or Vitriolated Bones.	Superphosphates.	Dissolved Compounds.		
	Ichaboe.	Peruvian (Riddled).	Fish Guano	Frey-Bentos Guano.									
Classes	Genuine.	Genuine.		a.	b.	a.	b.	a.			From	To	Average.
Phosphates—													
Dissolved	..	..	..	..	..	..	..	..	2/6	..	2/-	2/6	2/3
Undissolved	2/-	2/-	1/5	1/6	1/4	1/4	1/3	1/5	1/6	1/11	1/3	1/9	1/6
Ammonia	16/-	17/6	10/0	11/6	10/-	10/0	9/6	10/0	11/6	..	10/-	12/-	11/-
Potash	..	3/6	..	..	..	..	..	..	..	..	3/4	3/8	3/6
Prices per ton, March 1893, From	250/-	230/-	130/-	150/-	120/-	105/-	100/-	95/-	95/-	45/-	..	..	..
to	270/-	290/-	150/-	180/-	140/-	115/-	110/-	110/-	110/-	60/-	..	..	..

CLASSIFICATION OF MANURES.

Fish guano	Finely ground, and containing not more than 3 per cent oil.
Frey-Bentos guano	(*a*) Meat-meal, free from horn, yielding over 13 per cent ammonia. (*b*) Mixed scrap, yielding 7 to 8 per cent ammonia, and 30 to 40 per cent phosphates.
Bone-meal	(*a*) 90 per cent passing ⅛-inch sieve. (*b*) Coarser. Genuine bone-meal contains from 45 per cent to 55 per cent phosphates, and from 4½ per cent to 5½ per cent ammonia. The better qualities contain little or no fat.
Steamed bone-flour	Ground to flour and containing about 60 per cent phosphates, and about 2 per cent ammonia.
Dissolved bones	Must be pure—*i.e.*, containing nothing but natural bones and sulphuric acid.
Dissolved compounds	Including "dissolved-bone manures" and all special manures consisting of ingredients mixed together and *dissolved as a whole*. The "Average" units should be used in valuing ordinary well-made dissolved compounds. If the manure is of superior manufacture and of high concentration, the units used should be above the average; if of inferior manufacture, or of low concentration, the units used should be below average. In valuing such manures for Associations, the units employed must be specified.
Mixtures	To be valued according to the unit values (as given above) of the ingredients of which they are guaranteed *and also found* to be composed, with an addition of from 5 to 10 per cent according to the fineness of their manufacture.
Thomas-slag and ground phosphates	Fineness of grinding is of paramount importance. The coarsest kind used should be so finely ground that 80 per cent passes through a sieve of 10,000 holes per sq. inch.

Local Analytical Associations receiving grants from the Society must not use other units than these in valuing manures.

[1] See note, p. 40.

CASH PRICES (MARCH).

MANURES.

	Guarantee.	Price per Ton.	Unit.
	Per cent.	£ s. d.	
Sulphate of ammonia, 97 per cent	24 Am.	11 10 0	Am. = 9/7
Nitrate of soda, 95 per cent	19 "	10 5 0	" =10/9
Castor-cake dust	5.5 "	3 10 0	" =12/9
Horn-dust	15 "	8 10 0	" =11/4
Dried blood	15 "	8 0 0	" =10/7
Muriate of potash, 80 per cent	50 Pot.	8 15 0	Pot. = 8/6
Sulphate of potash, 50 per cent	27 "	5 5 0	" = 3/10
Kainit, 23 per cent	12 "	2 0 0	" = 3/4
Nitrate of potash, 73 per cent	14 Am. 40 Pot.	14 10 0	Am. =10/ Pot. = 3/9
Ground Charleston phos.	57 Phos.	3 0 0	Phos.=1/
Belgian phosphate	50 "	2 5 0	" = 0/11
Thomas-slag (fine) Scotch	30 "	1 16 0	" = 1/2
" " " English	37 "	2 3 0	" = 1/2
Phosphatic guano	67 " 1 Am.	5 0 0	" = 1/4 Am. =10/

FEEDING STUFFS.

	Analyses.			Price per Ton in bags.
	Album.	Oil.	Carbo-hydrates.	£ s. d.
Linseed-cake	28	10	35	8 15 0
Decorticated cotton-cake	45	8	20	7 5 0
Undecorticated do.	24	7	25	5 5 0
Liebig's meat-meal	70	12	..	10 0 0
Rape-cake	32	10	27	5 15 0
Bean-meal	25	2	50	7 15 0
Locust-bean meal	6	2	70	6 0 0
Dried grains	20	8	50	5 0 0
Indian corn	10	5	55	5 15 0
Paisley meal	15	9	60	4 15 0
Linseed (whole)	20	35	14	13 7 6
Linseed-oil	..	..	..	20 0 0
Molasses	..	..	..	5 10 0

INSTRUCTIONS FOR VALUING MANURES.

The commercial values of manures are determined by means of the UNITS in the following manner:—

Take the analysis of the manure, and look for the following substances:—

Phosphates dissolved (or soluble phosphate)	No other items but these are to be valued.
„ undissolved (or insoluble „)	
Ammonia	
Potash	

Should the analysis or the guarantee not be expressed in that way, the chemist or the seller should be asked to state the quantities in these terms.

Suppose the manure is bone-meal:—

There are two classes of bones, according to their fineness. An ordinary bone-meal will fall under Class (*a*), and it will contain about 50 per cent phosphate, and 5 per cent ammonia. The units for bones, Class (*a*), are 1s. 4d. for insoluble phosphate, and 10s. for ammonia. Therefore the value is—

Insol. phosphate,	50 times 1s. 4d.,	equal to	£3	6	8	
Ammonia,	5 „ 10s.	„	2	10	0	
		Say	£5	16	8	per ton.

Suppose the manure is dissolved or vitriolated bones:—

It must be guaranteed "pure."

The units in the Schedule are 2s. 9d. for soluble phosphate, 1s. 6d. for insoluble phosphate, and 12s. for ammonia.

The analysis will be about 15 per cent soluble phosphate, 20 per cent insoluble phosphate, and 3 per cent ammonia. In that case the value would be—

Sol. phosphate,	15 times 2s. 6d.,	equal to	£1	17	6	
Insol. „	20 „ 1s. 6d.	„	1	10	0	
Ammonia,	3 „ 11s. 6d.	„	1	14	6	
		Say	£5	2	0	per ton.

Suppose the manure is a superphosphate,—say an ordinary superphosphate, with 27 per cent soluble phosphate and 3 per cent insoluble phosphate. It is valued thus—

Sol. phosphate, 27 times 1s. 11d., equal to, say, £2 11 9 per ton.
Insoluble phosphate is not valued in a superphosphate.

Suppose the manure is a dissolved compound, such as *dissolved-bone manures*, or a special manure, such as a *turnip or potato manure*, it will be valued according to the units under "Dissolved Compounds," the *average* units for which are 2s. 3d. for soluble phosphate, 1s. 6d. for insoluble phosphate, 11s. for ammonia, and 4s. for potash, in the Schedule. Thus, an ordinary turnip manure containing 20 per cent soluble phosphate, 10 per cent insoluble phosphate, 3 per cent ammonia, and 2 per cent potash, would be valued thus—

Sol. phosphate,	20 times 2s. 3d.,	equal to	£2	5	0	
Insol. do.,	10 „ 1s. 6d.,	„	0	15	0	
Ammonia,	3 „ 11s.	„	1	13	0	
Potash,	2 „ 3s. 6d.	„	0	7	0	
		Say	£5	0	0	per ton.

Note.—The units have reference solely to the COMMERCIAL VALUES of Manures, and not to their AGRICULTURAL VALUES.

Thus, in stating soluble phosphate in dissolved bones at 2s. 6d. per unit, and that in superphosphate at 1s. 11d., it is meant that these are the prices per unit at which soluble phosphate can be bought in these two manures; but it does not mean that the soluble phosphate in the one is 7d. per unit better as a manure than that in the other. It is probably no better.

BOTANICAL DEPARTMENT.

Consulting Botanist to the Society—A. N. M'ALPINE, Minto House, Chambers Street, Edinburgh.

The Society have fixed the following rates of charge for the examination of plants and seeds for the *bona fide* and individual use and information of members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

Scale of Charges.

1. A report on the purity, amount, and nature of foreign materials, 2s.
2. On the germinating power of a sample of seed, 2s.
3. Determination of the species of any weed or other plant, or of any vegetable parasite, with a report on its habits and the means for its extermination or prevention, 5s.
4. Report on any disease affecting farm crops, 5s.
5. Determination of the species of any natural grass or fodder plant, with a report on its habits and pasture or feeding value, 1s.

The Consulting Botanist's Reports are furnished to enable members—purchasers of seeds and corn for agricultural purposes—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

Instructions for Selecting and Sending Samples.

In sending seed or corn for examination, the utmost care must be taken to secure a fair and honest sample. In the case of grass seeds, the sample would be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser. If anything supposed to be injurious or useless exists in the corn or seed selected, samples should also be sent.

When possible, at least one ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which the seed has been bought (but preferably, a copy of the invoice) should accompany the sample.

Grass seeds should be sent at least four weeks, and clover seeds two weeks, before they are to be used.

In collecting specimens of plants, the whole plant should be taken up and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

It is strongly recommended that members purchasing seeds should insist—

(1) Upon having from the seller a guarantee stating the purity and germination of the seed supplied.

(2) That the bulk be same as sample.

(3) That it contain not more than 5 per cent other than the species ordered.

If the purity and germination of the seed is not known, it is impossible to tell either its money value or the proper amount to be sown.

It is also strongly recommended that the purchase of prepared mixtures should be avoided, and the different seeds to be used should be purchased separately.

Parcels or letters containing seeds or plants for examination (carriage or postage paid) must be addressed to Professor M'Alpine, Botanical Laboratory, Minto House, Chambers Street, Edinburgh.

DAIRY DEPARTMENT.

The Society established in 1885 a Dairy Department, to promote the dairy interests.

During 1885, 1886, 1887, 1888, 1889, 1890, 1891, and 1892, the Society placed at the disposal of the Committee a sum of £100 to aid local efforts in the employment of itinerating Instructors and Demonstrators in Cheese and Butter making.

The grants have been appropriated among the different branches of the Scottish Dairy Associations as follows :—

Branch.	1889.	1890.	1891.	1892.
Ayrshire	...	...	...	...
Wigtownshire, Rhinns District } Wigtownshire, Lower District }	...	...	...	...
Kirkcudbright	...	...	...	...
Dumfriesshire	...	...	...	...
Royal Northern Society . .	...	...	£20 0 0	£20 0 0
Angus and Mearns Dairy School	...	...	20 0 0	20 0 0
Kilmarnock Dairy School .	£100 0 0	£100 0 0	60 0 0	60 0 0
	£100 0 0	£100 0 0	£100 0 0	£100 0 0

PREMIUMS.

GENERAL REGULATIONS FOR COMPETITORS.

1. It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the writers whose papers are published in the 'Transactions.'

2. All reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in competition; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the reporter—initials must not be used.

3. No sealed letter, unless belonging to a report found entitled to at least one-half of the Premium offered, will be opened without the author's consent.

4. Reports for which a Premium, or one-half of it, has been awarded, become the property of the Society, and cannot be published in whole or in part, nor circulated in any manner without the consent of the Directors. All other papers will be returned to the authors if applied for within twelve months.

5. When a report is unsatisfactory, the Society is not bound to award the whole or any part of a Premium.

6. All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each Premium must be strictly fulfilled. General essays, and papers compiled from books, will not be rewarded. Weights and measurements must be indicated by the imperial standards.

7. The Directors, before awarding a Premium, shall have power to require the writer of any report to verify the statements made in it.

8. The decisions of the Board of Directors are final and conclusive as to all Premiums, whether for Reports or at General or District Shows; and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

9. The Directors will welcome papers from any Contributor on any suitable subject not included in the Premium List; and if the topic and the treatment of it are both approved, the writer will be remunerated, and his paper published.

CLASS I.

REPORTS.

Section 1.—THE SCIENCE AND PRACTICE OF AGRICULTURE.

FOR APPROVED REPORTS.

1. On the results of experiments for fixing and retaining the volatile and soluble ingredients in Farmyard Manure—Twenty Sovereigns. To be lodged by 1st November in any year.

The Report must detail the treatment adopted to fix and retain these ingredients—the materials used for that purpose, and the quantity and cost thereof—comparative analyses of the manure with and without the treatment, and also a statement of the crops grown with manure and without such treatment, must be given by the Reporter. The experiments to have extended over at least two years and crops.

2. On the results of experiments for ascertaining the comparative value of Farmyard Manure obtained from cattle fed upon different varieties of food, by the application of such manure to farm crops—Twenty Sovereigns. To be lodged by 1st November in any year.

The Report must state the effects produced on two successive crops by the application of manure obtained from cattle fed on different sorts of food, such as turnips and straw alone; and turnips and straw, with an addition of oilcake, linseed, bean-meal, grain, or other substances. The animals should be as nearly as possible of the same age, weight, condition, and maturity, and each lot should receive daily the same quantity of litter; and, except as to the difference of food, they must be treated alike.

The preparation of the manure, by fermentation or otherwise, should be in every respect the same; and it is desirable that not less than two several experiments be made with each kind, and that the ground to which it is to be applied be as equal as possible in quality and condition.

3. On the hardy and useful Herbaceous Plants of any country, where such climate exists as to induce the belief that the plants may be beneficially introduced into the cultivation of Scotland

—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

Attention is particularly directed to the grains and grasses of China, Japan, the Islands of the Eastern Archipelago, the Himalaya country, the Falkland and South Sea Islands, California, and the high north-western district of America.

Reporters are required to give the generic and specific names of the plants treated of, with the authority for the same—together with the native names, so far as known; and to state the elevation of the locality and nature of the soil in which they are cultivated, or which they naturally inhabit, with their qualities or uses; and it is further requested that the descriptions be accompanied, in so far as possible, with specimens of the plants, and their fruit, seed, and other products.

4. On the comparative advantages of Fattening Cattle in stalls, courts, or covered yards—Twenty Sovereigns. To be lodged by 1st November in any year.

The Report must detail the comparative result of actual experiments. The same quantities and kinds of food must be used. Information is required as to the comparative expense of attendance, the cost of erecting the buildings, and any other circumstances deserving of attention. The state of the weather during the experiment, in point of temperature and wetness, and the advantages or disadvantages of clipping cattle put up to feed, must be particularly noted and reported.

5. On experiments for ascertaining the actual addition of weight to growing or fattening Stock, by the use of different kinds of food—Twenty Sovereigns. To be lodged by 1st November in any year.

The attention of the experimenter is directed to turnips, carrots, beet, mangel-wurzel, potatoes, cabbage, as well as to beans, oats, barley, Indian corn, linseed, oilcake or rape-cake, and to the effect of warmth and proper ventilation, and the difference between food cooked and raw. The above roots and other kinds of food are merely suggested; competitors are neither restricted to them nor obliged to experiment on all of them.

When experiments are made with linseed and cake, attention should be paid to the comparative advantages, economically and otherwise, of the substance in these two states.

Before commencing the comparative experiments, the animals must be fed alike for some time previously.

The progress of different breeds may be compared. This will form an interesting experiment of itself, for Reports of which encouragement will be given.

N.B.—The experiments specified in the two previous subjects must be conducted over a period of not less than three months. No lot shall consist of fewer than four Cattle or ten Sheep. The animals selected should be of the same age, sex, and breed, and as nearly as possible of the same weight, condition, and maturity. The live weight before and after the experiment must be stated, and if killed, their dead weight and quantity of tallow.

6. On the comparative Feeding Value of Ensilage, alone or with other ordinary farm produce—Fifteen Sovereigns. To be lodged by 1st February 1895.

The Report must detail the comparative result of actual experiments; and the same quantities and kinds of food must be used.

7. On any useful practice in Rural Economy adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal. To be lodged by 1st November in any year.

The purposes chiefly contemplated by the offer of this premium is to induce travellers to notice and record such particular practices as may seem calculated to benefit Scotland. The Report to be founded on personal observation.

SECTION 2.—ESTATE IMPROVEMENTS.

FOR APPROVED REPORTS.

1. By the Proprietor in Scotland who shall have executed the most judicious, successful, and extensive Improvement—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

Should the successful Report be written for the Proprietor by his resident factor or farm manager, a Minor Gold Medal will be awarded to the writer in addition to the Gold Medal to the Proprietor.

The merits of the Report will not be determined so much by the mere extent of the improvements, as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

2. By the Proprietor in Scotland who shall have erected on his estate the most approved Farm-buildings—The Gold Medal. Reports, Plans, and Specifications to be lodged by 1st November in any year.

3. By the Proprietor or Tenant in Scotland who shall have reclaimed within the ten preceding years not less than forty acres of Waste Land—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

4. By the Tenant in Scotland who shall have reclaimed within the ten preceding years not less than twenty acres of Waste Land —The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

5. By the Tenant in Scotland who shall have reclaimed not less than ten acres within a similar period—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The Reports in competition for Nos. 3, 4, and 5 may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the lands reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improve-

ment—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot be made up of different patches of land, the improvement must have relation to one subject; it must be of profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return* and a certified measurement of the ground are requisite.

6. By the Proprietor or Tenant in Scotland who shall have improved within the ten preceding years the Pasturage of not less than thirty acres, by means of top-dressing, draining, or otherwise, without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

7. By the Tenant in Scotland who shall have improved not less than ten acres within a similar period—The Minor Gold Medal. To be lodged by 1st November in any year.

Reports in competition for Nos. 6 and 7 must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

SECTION 3.—HIGHLAND INDUSTRIES AND FISHERIES.

FOR APPROVED REPORTS.

1. The best mode of treating native Wool; cleaning, carding, dyeing, spinning, knitting, and weaving by hand in the Highlands and Islands of Scotland—Five Sovereigns. To be lodged by 1st November 1894.

SECTION 4.—MACHINERY.

FOR APPROVED REPORTS.

SECTION 5.—FORESTRY DEPARTMENT.

FOR APPROVED REPORTS.

1. On Plantations of not less than eight years' standing formed on deep peat-bog—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November 1894.

The premium is strictly applicable to deep peat or flow moss; the condition of the moss previous to planting, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

2. On the more extended introduction of hardy, useful, or ornamental Trees, which have not hitherto been generally cultivated in Scotland—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The Report should specify as distinctly as possible the kind of trees introduced. The adaptation of the trees for use or ornament, and their comparative progress, should be mentioned. Attention is directed to the introduction of any tree as a nurse in young plantations, which by growing rapidly for several years, and attaining maturity when at the height of 20 or 25 feet, might realise the advantage and avoid the evils of thick planting.

3. On the Life-History of any Insect or Tribe of Insects which is injurious to British Forest Trees (*e.g.*, *Scolytus destructor*, of the Elm)—Fifteen Sovereigns. To be lodged by 1st November 1894.

The means for guarding against or destroying these pests to be mentioned, and the Report to be illustrated by original drawings and specimens of the insect and its ravages.

The *Pine Beetle*, the *Fir Weevil*, the *Black Arch Nun* (or *Spruce Moth*), and the *Elm-bark Beetle* are excluded, having been already reported on.

CLASS II.

DISTRICT COMPETITIONS.

REGULATIONS 1894.

The Money Premiums and Medals awarded at District Competitions will be sent direct to the winners in January next. No payments must therefore be made by the Secretary or Treasurer of any local Association.

Grants in aid of DISTRICT COMPETITIONS *for* 1895 *must be applied for before* 1*st November* 1894, *on Forms to be obtained from the Secretary.*

When a Grant has expired, the District cannot apply again for aid for two years.

SECTION I.—GRANTS TO DISTRICT SOCIETIES FOR HORSES, CATTLE, SHEEP, AND PIGS.

1. CLASS OF STOCK—LIMIT OF GRANTS, £340.—The Highland and Agricultural Society will make Grants to District Societies to deal with, as in the opinion of the District Societies the need of each district may require, for such classes of breeding Stock of Horses, Cattle, Sheep, and Pigs as are embraced in the General Show Prize List of the Highland and Agricultural Society. The total sum to be expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £340 in any one year.

2. GRANT TO DISTRICT, £12.—The portion of the Grant to any one District Society shall not exceed the sum of £12 in any one year.

3. CONTINUANCE OF GRANT THREE YEARS—ADVERTISING.—The Grant shall continue for three alternate years, provided always that the District

Society shall, in the two intermediate years, continue the competition by offering Premiums equal in amount to not less than one-half the sum given by the Highland and Agricultural Society, and for the same class of Stock as that selected in each previous year to compete for the Highland and Agricultural Society's Prizes. The Prizes when given by the Highland and Agricultural Society must be announced as their gift. If no competition takes place for two years the Grant expires.

4. When it is agreed to hold the General Show of the Society in any district, no provincial show shall be held in that district in the months of June, July, or August.

5. Medals.—In the two alternate years the Highland and Agricultural Society will place three Minor Silver Medals at the disposal of the District Societies, for the same classes of Stock as those for which the Money Premiums are offered, provided that not less than three lots are exhibited in the same class.

6. Rules of Competition.—The Rules of Competition for the Premiums, the Funds for which are derived from Grants of the Highland and Agricultural Society, shall be such as are generally enforced by the Society receiving the Grant for Premiums offered by itself.

7. Area and Parishes—Five Parishes.—When making application for Grants from the Highland and Agricultural Society, the District Society must delineate the area and the number of parishes comprised in the district, and *except in special cases*, no District Society shall be entitled to a Grant whose show is not open to at least *five* Parishes.

8. Nomination of Members.—The Directors shall nominate one or more members of the Highland and Agricultural Society resident in the district, whose duty it shall be to see that the conditions imposed by the Board are complied with.

9. Reports.—Blank Reports will be furnished to the Secretaries of the different District Societies. These Reports must in all details be completed and lodged with the Secretary of the Highland and Agricultural Society on or before the 1st of November next following the competition, both in the years when the Grant is given and in the two intermediate years, for the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. All such Reports must be signed and certified by the Members of the Highland and Agricultural Society nominated under Rule 8.

10. Grants—When Paid.—The Grants made to District Societies will be paid in the January following the competition, by Precepts issued by the Directors of the Highland and Agricultural Society to the winners of the prizes. No payments of these Grants must be made by the Secretary or Treasurer of any District Society. Medals will be issued at the same time.

11. Renewal of Application.—No application for renewal of a Grant to a District Society will be entertained until the expiration of *two years* from the termination of the last Grant.

12. Disposal of Applications.—In disposing of applications for District Grants, the Directors of the Highland and Agricultural Society shall keep in view the length of interval that has elapsed since the expiration of the last Grant, giving priority to those District Societies which have been longest off the list.

13. Dairy Produce.—Upon application being made by District Societies, a limited number of Medals will be placed at the Disposal of District Societies for Dairy Produce.

DISTRICTS.

1. ARGYLL.—*Convener*, J. Campbell of Kilberry, Tarbert; *Secretary*, Duncan M'Laren, Union Bank, Tarbert. Granted 1894.
2. CARRICK.—*Convener*, Alexander Cross of Knockdon, 19 Hope Street, Glasgow; *Secretary*, David Brown, Banker, Maybole. Granted 1894.
3. MORAYSHIRE.—*Convener*, James Brander, Pittendreich, Elgin; *Secretary*, James Black of Sheriffston, Elgin. Granted 1894.
4. KINGLASSIE.—*Convener and Secretary*, James Inglis, Redhouse, Cardenden. Granted 1894.
5. FORTH.—*Convener and Secretary*, Thomas Nimmo, Lawhead, Forth, Lanark. Granted 1894.
6. WEEM.—*Convener*, Robert Menzies, Tirinie, Aberfeldy; *Secretary*, J. B. Feilding, Camserney Cottage, Aberfeldy. Granted 1894.
7. SPEY, AVEN, AND FIDDOCHSIDE.—*Convener*, Sir George Macpherson-Grant of Ballindalloch, Bart.; *Secretary*, A. R. Stuart of Inverfiddich, Craigellachie. Granted 1891.
8. JED-FOREST.—*Convener*, Gideon Pott, Knowesouth, Jedburgh; *Secretary*, Richard Davidson, Swinnie, Jedburgh. Granted 1891.
9. CENTRAL BANFFSHIRE.—*Convener*, John M'Pherson, Mulben, Keith; *Secretary*, George Donald, Ladyhill, Grange, Keith. Granted 1893.
10. STRATHSPEY.—*Convener*, John Smith, Inverallan House, Grantown; *Secretary*, D. G. Lawson, Auchnagallen, Grantown. Granted 1893.
11. WEST LINTON.—*Convener*, George Forrest, Edston, Peebles; *Secretary*, F. W. Dyson, Crossburn, Peebles. Granted 1893.
12. ISLAY, JURA, AND COLONSAY.—*Convener*, J. S. R. Ballingall, Eallabus House, Islay; *Secretary*, Robert Cullen, Bridgend, Islay. Granted 1893.
13. WEST TEVIOTDALE.—*Convener and Secretary*, James Oliver, Thornwood, Hawick. Granted 1893.
14. KINCARDINESHIRE.—*Convener*, John Hart, Cowie Mains, Stonehaven; *Secretary*, A. B. Annandale, Stonehaven. Granted 1892.

In 1894.

Nos. 1, 2, 3, 4, 5, and 6 are in competition for the first year.
Nos. 7, 8, 9, 10, 11, 12, and 13 compete for local Premiums.
No. 14 is in abeyance on account of the Aberdeen Show.

SECTION 2.—GRANTS TO HORSE ASSOCIATIONS, &c., FOR STALLIONS FOR AGRICULTURAL PURPOSES.

1. HORSES—LIMIT OF GRANT, £210.—The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £210 in any one year.

2. GRANT TO EACH, £15.—The portion of the Grant to any one Horse Association, &c., shall not exceed the sum of £15 in any one year.

3. CONTINUANCE OF GRANT THREE YEARS—INTERMEDIATE YEAR.—The Grant shall continue for three alternate years, provided always that the Horse Association or Society shall, in the two intermediate years, offer at least a sum equal in amount to that granted by the Highland and Agricul-

tural Society for the hire of a Horse in connection with the Association or Society to whom the Grant is made.

4. NOMINATION OF MEMBERS.—The Directors of the Highland and Agricultural Society shall nominate one or more members of the Highland and Agricultural Society, resident in the Districts in which the Society benefited is located, whose duty it shall be to see that the conditions imposed by the Board are complied with.

5. REPORTS—PENALTY FOR NOT ENGAGING HORSE.—No grant by the Highland and Agricultural Society to Horse Associations, &c., will be paid unless a report, signed and certified by the members appointed under Rule 4, be furnished to the Highland and Agricultural Society not later than the 1st of November in each year in which the Grant is made, and also in the alternate years, stating that a Horse has been engaged by the Horse Association or other Society to whom the Grant is made; and in the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

6. RULES 10 (Time of Payment), 11 (Renewal of Grant), and 12 (Disposal of Applications) applicable to Section 1, shall be applicable to Section 2.

DISTRICTS.

1. LAUDERDALE.—*Convener*, R. Dickinson, Longcroft, Lauder; *Secretary*, George L. Broomfield, Lauder. Granted 1894.
2. NORTHERN DISTRICT OF KINCARDINESHIRE HORSE SOCIETY.—*Convener and Secretary*, John Hart, Mains of Cowie, Stonehaven. Granted 1894.
3. ORKNEY HORSE-BREEDING SOCIETY.—*Convener*, James Drever, Swannay, Finstown, Orkney; *Secretary*, Robert Scarth, Binscarth, Finstown, Orkney. Granted 1894.
4. STRATHEARN CENTRAL.—*Convener and Secretary*, Robert Gardiner, Henhill, Forteviot. Granted 1894.
5. NAIRNSHIRE.—*Convener*, R. Anderson of Lochdhu, Nairn; *Secretary*, John Joss, Budgate, Cawdor, Nairn. Granted 1891.
6. INVERNESS FARMERS' SOCIETY.—*Convener*, Duncan Forbes of Culloden, Inverness; *Secretary*, G. J. Campbell, 12 Lombard Street, Inverness. Granted 1893.
7. SPEYSIDE CLYDESDALE HORSE-BREEDING ASSOCIATION.—*Convener*, Col. John Gordon Smith of Delnabo, Glenlivet, Ballindalloch; *Secretary*, A. R. Stuart of Inverfiddich, Craigellachie. Granted 1893.
8. LOWER WARD OF RENFREWSHIRE STALLION SOCIETY.—*Convener*, R. Sinclair Scott, Burnside, Largs; *Secretary*, R. Stewart Walker, 12 William Street, Greenock. Granted 1893.

In 1894.

Nos. 1, 2, 3, and 4 are in competition for the first year.
Nos. 5, 6, 7, and 8 compete for local premiums.

DAIRY PRODUCE.

Upon application being made by District Societies, a limited number of Medals will be placed at the disposal of District Societies for Dairy Produce.

SPECIAL GRANTS.

£20 to the Ayrshire Agricultural Association, to be competed for at the Dairy Produce Show at Kilmarnock.—*Convener*, The Hon. G. R.

Vernon, Auchans House, Kilmarnock; *Secretary*, James M'Murtrie, Ayr. Granted 1872.

£5 to Shetland Agricultural Society.—*Convener*, John Bruce of Sumburgh, Lerwick; *Joint-Secretaries*, Archibald J. Garrioch and D. M'Arthur, Lerwick. Granted 1893.

£3 to Orkney.—*Secretary*, James Johnston, Orphir House, Orkney. Granted 1883.

£3 to South Uist and Barra.—*Convener and Secretary*, Donald Paterson, Askernish, South Uist, Oban. Granted 1890.

£3 to North Uist.—*Convener*, Sir John Campbell Orde, Bart.; *Secretary*, James M. Fraser, Banker, Lochmaddy. Granted 1890.

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society, being anxious to co-operate with local Associations, will give a limited number of Minor Silver Medals annually to Societies, not on the list of Cattle, Horse, or Sheep Premiums, in addition to the Money Premiums awarded in the Districts for—

1. Best Bull, Cow, Heifer of any pure breed, or Ox.
2. Best Stallion, Mare, or Gelding.
3. Best Tup, or Pen of Ewes or Wethers.
4. Best Boar, Sow, or Pig.
5. Best Coops of Poultry.
6. Best Sample of any variety of Wool.
7. Best Sample of any variety of Seeds.
8. Best managed Farm.
9. Best managed Green Crop.
10. Best managed Hay Crop.
11. Best managed Dairy.
12. Best Sweet-Milk Cheese.
13. Best Cured Butter.
14. Best sample of Honey, not less than 5 lb., taken without destroying the bees.
15. Best collection of Roots.
16. Best kept Fences.
17. Male Farm Servant who has been longest in the same service, and who has proved himself most efficient in his duties, and to have invariably treated the animals under his charge with kindness.
18. Female Servant in charge of Dairy and Poultry who has been longest in the same service, and who has proved herself most efficient in her duties, and to have invariably treated the animals under her charge with kindness.
19. Best Sheep-Shearer.
20. Most expert Hedge-Cutter.
21. Most expert Labourer at Draining.
22. Most expert Farm Servant at trial of Reaping-Machines.
23. Best Maker of Oat-Cakes.

It is left to the local Society to choose out of the foregoing list the classes for which the Medals are to be competed.

The Medals are granted for two years.

In 1889 it was resolved that in future no Society shall receive more than two Medals for two years.

Aberdeenshire.

1. Aberdour.—*Convener*, Alex. Lovie, Nether Boyndlie, Fraserburgh; *Secretary*, Wm. Chapman, Woodhead, Aberdour, Fraserburgh. 2 Medals. 1893.
2. Ebrieside.—*Convener*, John Grant, Banker, Methlick; *Secretary*, Alex. Fowler, Auchnagatt. 2 Medals. 1893.
3. Kennethmont.—*Convener*, Wm. A. Mitchell, Auchnagathel, Keig, Whitehouse; *Secretary*, James R. Moir, 4 Belmont Road, Aberdeen. 2 Medals. 1893.
4. North of Scotland Bee Society.—*Convener*, D. C. Darling, 11 Bridge Street, Aberdeen; *Secretary*, A. M. Byres, C.A., 18 Union Terrace, Aberdeen. 2 Medals. 1893.

Argyllshire.

5. Ardnamurchan, Moidart, and Sunart.—*Convener and Joint-Secretary*, Robert Colthart, Achateny, Ardnamurchan; *Joint-Secretary*, R. D. Coltart, Achateny, Ardgour. 2 Medals. 1893.
6. Dunoon.—*Convener*, John Mercer, Ardnadam, Sandbank; *Secretary*, John Dobie, Clydesdale Bank, Dunoon. 2 Medals. 1894.

Ayrshire.

7. Ardrossan.—*Convener*, Andrew Allan, North Kirkland, Dalry; *Secretary*, Andrew Stirrat, Saltcoats. 2 Medals. 1893.
8. Beith.—*Convener*, Peter Skeoch, Boydstone, Beith; *Secretary*, Matthew Gilmour, Clydesdale Bank, Beith. 2 Medals. 1893.
9. Girvan.—*Convener*, The Earl of Stair, K.T., Bargany House, Girvan; *Secretary*, Andrew Dunlop, Royal Bank, Girvan. 2 Medals. 1894.
10. Monkton, Newton, Prestwick, and St Quivox.—*Convener*, John Russell, Craigie Home Farm, Ayr; *Secretary*, James Andrew, Prestwick. 2 Medals. 1894.
11. West Kilbride.—*Convener*, John Crawford, Millstonford, West Kilbride; *Secretary*, William Logan, Glenhead, West Kilbride. 2 Medals. 1894.
12. New Cumnock.—*Convener*, Hugh Hamilton of Pinmore, Ayr; *Secretary*, John C. Candlish, Muirfoot, New Cumnock. 2 Medals. 1893.

Berwickshire.

13. Lauderdale Bee-Keepers.—*Convener*, Geo. L. Broomfield, Lauder; *Secretary*, Robert Robson, Lauder. 2 Medals. 1894.

Dumfriesshire.

14. Moffat and Upper Annandale.—*Convener*, John Waugh, Granton, Moffat; *Secretary*, William Tait, Church Place, Moffat. 2 Medals. 1894.

Inverness-shire

15. North Uist.—*Convener*, Sir John Campbell Orde, Bart.; *Secretary*, James M. Fraser, Banker, Lochmaddy. 2 Medals. 1893.

Kirkcudbrightshire.

16. Carsphairn.—*Convener*, W. Kennedy, Claremont, Ayr; *Secretary*, John Galloway, Carsphairn, Galloway. 2 Medals. 1894.

Lanarkshire.

17. Shettleston and Chryston.—*Convener*, Alex. Murdoch, Gartcraig, Shettleston; *Secretary*, James Denholme, Cardowan, Shettleston. 2 Medals. 1893.

Nairnshire.

18. Nairnshire Ornithological.—*Convener*, Robert Anderson of Lochdhu, Nairn; *Secretary*, R. S. Falconer, 18 Falconer's Lane, Nairn. 2 Medals. 1894.

Peeblesshire.

19. Upper Tweedside.—*Convener*, G. Deans Ritchie, Chapelgill, Broughton; *Secretary*, Duncan M. Fletcher, Drumelzier Place, Broughton. 2 Medals. 1894.

Perthshire.

20. Moulin.—*Convener and Secretary*, Robert M'Gillewie, Union Bank, Dunkeld. 1 Medal. 1893.

Ross-shire.

21. Northern Pastoral Club.—*Convener*, Peter Robertson, Achilty, Strathpeffer; *Secretary*, Alexander Gunn, V.S., Beauly. 2 Medals. 1894.

Roxburghshire.

22. Liddlesdale.—*Convener*, George L. Oliver, Whithaugh, Newcastleton; *Secretary*, Alexander Thomson, Banker, Newcastleton. 2 Medals. 1894.

23. Roxburghshire Bee-Keepers.—*Convener*, William L. Johnston, Oxnam Neuk, Jedburgh; *Secretary*, Thomas Clark, Pleasants Schoolhouse, Jedburgh. 2 Medals. 1893.

Applications from other Districts must be lodged with the Secretary of the Society *by 1st November next.*

RULES OF COMPETITION.

1. All Competitions must be at the instance of a local Society.

2. The classes for which Medals are granted must be in accordance with the list at page 51. The Committee shall select the classes, and specify them in the return.

3. In each District the Convener (who must be a member of the Society appointed by the Directors) shall fix the time and place of Competition, appoint the Judges, and make all other necessary arrangements, in concurrence with the other members of the Society, and the local Association of the District.

4. The Money Premiums given in the District must be £2 for each Medal claimed.

5. The Medal for Sheep-Shearing shall not be awarded unless there are three competitors, and it shall always accompany the highest Money

Premium. There must not be fewer than two competitors in all the classes.

6. Blank reports will be furnished to all the Conveners and Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary *on or before the 1st of November next*, with the exception of green crop reports, which must be forwarded on or before the 20th of December, for the approval of the Directors, against whose decisions there shall be no appeal.

7. When a grant has expired, the District cannot apply again for aid for two years, and if no competition takes place in a District for two years the grant expires.

PLOUGHING COMPETITIONS.

The Minor Silver Medal will be given to the winner of the first or highest Premium at Ploughing Competitions, provided a Report in the following terms is made to the Secretary, within one month of the Competition, by a Member of the Society:—

FORM OF REPORT.

I, of , Member of the Highland and Agricultural Society, hereby certify that I attended the Ploughing Match of the Association at in the county of on the when ploughs competed; of land were assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz.:—

[*Here enumerate the names and designations of successful Competitors.*]

RULES OF COMPETITION.

1. All Matches must be at the instance of a local Society or Ploughing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of the Secretary, must be registered with the Secretary of the Highland and Agricultural Society, 3 George IV. Bridge, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can only report one Match, and a Ploughman cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal there must have been twelve ploughs in Competition, and Three Pounds awarded in Premiums by the local Society. The Medal to be given to the winner of the first or highest prize.

7. Ploughmen shall not be allowed any assistance, and their work must not be set up nor touched by others; on land of average tenacity the ploughing should be at the rate of an imperial acre in ten hours, and attention should be given to the firmness and sufficiency of the work below more than to its neatness above the surface.

CLASS III.

COTTAGES AND GARDENS.

The following Premiums are offered for Competition in the Parishes after mentioned.

The Premiums are granted for two years.

PREMIUMS FOR BEST KEPT COTTAGES AND GARDENS.

1.	Best kept Cottage	£1 0 0
	Second best	0 10 0
2.	Best kept Cottage Garden	1 0 0
	Second best	0 10 0

Aberdeenshire.

1. BIRSE.—*Convener*, W. E. Nicol, Ballogie, Aboyne; *Secretary*, William Adams, Schoolhouse, Finzean, Aboyne. Granted 1893.

Fifeshire.

2. PITLESSIE.—*Convener*, William Dingwall, Ramornie, Ladybank; *Secretary*, Henry Mitchell, Pitlessie, Ladybank. Granted 1893.

RULES OF COMPETITION.

1. Competitions may take place in the different parishes for Cottages and Gardens, or for either separately.

2. The occupiers of Lodges at Gentlemen's Approach Gates and Gardeners' Houses are excluded, as well as others whom the Committee consider, from their position, not to be entitled to compete. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judges.

3. It is left to the Committee of the District to regulate the maximum annual rent of the Cottages, which may, with the garden, be from £5 to £7.

4. To warrant the award of full Premiums, there must not be fewer than three competitors in each class. If there are less than three competitors in each class, only half Premium will be awarded.

5. A person who has gained the highest Premium cannot compete again.

6. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is thatch, it must be in good repair, though in the occupation of a tenant. The interior and external conveniences must be clean and orderly—the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to the above requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

7. In estimating the claims for the Garden Premiums, the judges should have in view—The sufficiency and neatness of the fences and walks; the cleanness of the ground; the quality and choice of the crops; and the general productiveness of the garden.

8. Reports, stating the number of Competitors, the names of successful

parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary *on or before the* 1*st November next.*

9. When a grant has expired, the District cannot apply again for aid for two years.

Parishes desirous of these Premiums must lodge applications with the Secretary *on or before the* 1*st November next.*

MEDALS FOR COTTAGES AND GARDENS OR GARDEN PRODUCE.

The Society will issue annually two Minor Silver Medals to a limited number of local Associations or individuals, who at their own expense establish Premiums for Cottages or Gardens under £15 of Rent. The Medals may be awarded for best kept Cottage, and best kept Garden or Flower Plot, or Garden Produce, the produce of the cottager's own garden.

Local Associations or individuals desirous of these Medals, must lodge applications with the Secretary *on or before the* 1*st November next.*

The Medals are granted for two years.

Ayrshire.

1. Galston.—*Convener*, J. H. Turner, Portland Estates Office, Kilmarnock; *Secretary*, Abram Yendall, jun., 20 Barr Street, Galston. 2 Medals. 1892.

Banffshire.

2. Lintmill.—*Convener*, C. Y. Michie, Cullen House, Cullen; *Secretary*, George Bruce, Tochineal, Cullen. 2 Medals. 1894.

Dumbartonshire.

3. Vale of Leven and Dumbarton.—*Convener*, W. E. Gilmour, Woodbank, Alexandria, N.B.; *Secretary*, Archd. M'Dougall, 1 Wilson Street, Alexandria, N.B. 2 Medals. 1893.

Fifeshire.

4. Letham and District.—*Convener*, Thomas Webster, Nisbetfield, Ladybank; *Secretary*, Robert J. P. Spence, Letham, Collessie. 2 Medals. 1894.

Forfarshire.

5. Panbride and Arbirlot.—*Convener*, George Cowe, Balhousie, Carnoustie; *Secretary*, James Kydd, Scryne, Carnoustie. 2 Medals. 1894.

Lanarkshire.

6. New Victoria Gardens, Pollokshields.—*Convener*, ; *Secretary*, Daniel Frew, Maxwell Road, Pollokshields. 2 Medals. 1894.

Perthshire.

7. Breadalbane, Glenlyon, Weem, Strathtay, and Grantully.—*Convener*, Peter Haggart, Breadalbane Mills, Aberfeldy; *Secretary*, Robert Reid, Ashville, Aberfeldy. 2 Medals. 1894.

8. MENZIES FLOWER SHOW.—*Convener*, Sir Robert Menzies of that Ilk, Bart.; *Secretary*, A. T. Ross, Schoolhouse, Weem, Aberfeldy. 2 Medals. 1894.

9. SCONE.—*Convener*, Alex. Macduff of Bonhard, Perth; *Secretary*, Archd. Harris, New Scone, Perth. 2 Medals. 1893.

10. STANLEY.—*Convener*, C. A. Murray, Taymount, Stanley; *Secretary*, James Haggart, Percy Street, Stanley. 2 Medals. 1894.

Renfrewshire.

11. SIR JOHN MAXWELL GARDENS' SOCIETY.—*Convener*, James Hunter, Braehead House, Cathcart; *Secretary*, Robert R. Whitelaw, 19 High Cartcraigs, Pollokshaws. 2 Medals. 1893.

Stirlingshire.

12. CAMPSIE.—*Convener*, C. M. King, Antermony House, Milton of Campsie; *Secretary*, Watson Hunter, Lennoxtown, Campsie. 2 Medals. 1893.

13. FALKIRK.—*Convener*, John Shields, Linlithgow; *Secretary*, John Fleming, 158 High Street, Falkirk. 2 Medals. 1894.

Wigtownshire.

14. WIGTOWNSHIRE.—*Convener*, ; *Secretary*, James Ross, County Buildings, Stranraer. 2 Medals. 1894.

REGULATIONS.

1. Competitions may take place in the different districts for Cottages and Gardens, or for either separately.

2. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, must not exceed £15. The occupiers of Lodges at Gentlemen's Approach Gates, and Gardeners in the employment of others, are not entitled to compete.

3. If Competition takes place for Garden Produce in place of the best kept Garden, such produce must be *bona fide* grown in the Exhibitor's Garden, and he will not be allowed to make up a collection from any other Garden.

4. To warrant the award of the Medals, there must not be fewer than three Competitors.

5. Blank reports will be furnished to the Conveners and Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary *on or before the 1st November next*, for the approval of the Directors, against whose decisions there shall be no appeal.

6. When a grant has expired, the District cannot apply again for aid for two years, and if no competition takes place in a District for two years the grant expires.

IMPROVING EXISTING COTTAGES.

To the Proprietor in Scotland who shall report the Improvement of the greatest number of Cottages during the years 1891, 1892, and 1893—The Gold Medal.

BUILDING NEW COTTAGES.

To the Proprietor in Scotland who shall report the Erection of the greatest number of approved Cottages during the years 1890, 1891, 1892, and 1893—The Gold Medal.

RULES OF COMPETITION.

1. Claims for the Premiums must be lodged with the Secretary on or before the 1st of October next, to allow an inspection to be made of the different Cottages. The inspection will be conducted by a Committee of the Society's Members, and Reports must be transmitted to the Secretary *on or before the 1st November next.*

2. The annual value of the Cottage or Cottages separately, with the garden ground, must not exceed £5.

3. In estimating the claims of the Competitors, the following points will be kept in view: The external appearance of the Cottages; their internal accommodation; the arrangements of the out-houses; the means of drainage and ventilation; and the expense of the building or of the alteration, compared with its durability and accommodation. When the Cottages of one Competitor are superior in style and comfort to those of another, though not so numerous, the Inspectors will give them preference, provided they amount at least to three, and have been erected at a moderate expense.

4. Parties competing will forward to the Society Plans, Specifications, and Estimates, of which, and of all information sent therewith, copies may be taken for publication, if the Society shall see fit, and the originals returned to the parties within six months, if desired.

Subject to Orders issued by the Board of Agriculture

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

GENERAL SHOW OF STOCK AND IMPLEMENTS

ON THE LINKS

ABERDEEN

ON 24TH, 25TH, 26TH, AND 27TH JULY 1894.

LAST DAYS OF ENTRY.

IMPLEMENTS AND OTHER ARTICLES—Monday, 21st May.

STOCK, POULTRY, AND DAIRY PRODUCE—Monday, 18th June.

No Entry at ordinary fees taken later than those which are received at the Society's Office, Edinburgh, by first post, or 10 o'clock, on Monday morning (18th June). Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (20th June), at the Society's Office, Edinburgh, at 10 o'clock.

COVERED BOOTHS FOR OFFICES—Monday, 18th June.

President of the Society.

HIS ROYAL HIGHNESS THE DUKE OF YORK, K.G.

Convener of the Local Committee.

ALEX. M. GORDON, ESQ. OF NEWTON, INSCH.

The District connected with the Show comprises the Counties of Aberdeen, Banff, Forfar (Eastern Division), and Kincardine.

REGULATIONS.

GENERAL CONDITIONS.

1. The Competition, except where otherwise stated, is open to Exhibitors from all parts of the United Kingdom.

2. Every Lot must be intimated by a Certificate of Entry, lodged with the Secretary *not later than Monday,* 21*st May, for Implements and other Articles, and Monday,* 18*th June, for Stock, Poultry, and Dairy Produce.*

No Entry taken at ordinary fees later than those which are received at the Society's Office by first post, or 10 o'clock, on Monday morning, 18th June. Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (20th June), at the Society's Office, Edinburgh, at 10 o'clock. Printed forms of Entry will be issued on application to the Secretary, No. 3 George IV. Bridge, Edinburgh. Admission Orders will be forwarded to Exhibitors, by Post, previous to the Show.

Protests. 3. Protests against the awards of the Judges, or against a violation of the judging regulations, must be lodged with the Secretary, at his Office in the Showyard, not later than 9 A.M. on Wednesday, the second day of the Show, and parties must be in attendance at the Committee Room, in the Showyard, at 9.30 A.M. that day, when protests will be disposed of. All protests must be accompanied by the deposit of £2, 2s., and if not sustained the sum may be forfeited at the discretion of the Directors.

4. Protests lodged for causes which the protester produces no good evidence to substantiate will render him liable to be reported to the Board of Directors, with the view, if they see reason, of his being prohibited from again entering Stock for a General Show.

Society not liable. 5. The Society shall not be liable for any loss or damage which Stock, Poultry, Dairy Produce, Implements, or other articles may sustain at the Show, or in transit.

Decisions of Board. 6. The decisions of the Board of Directors are final in all questions respecting Premiums and all other matters connected with the Show, and it shall not be competent for any Exhibitor to appeal against such decisions to, nor seek redress in respect of them from, any other tribunal.

Covered Booths. 7. Covered Booths for Offices (9 feet by 9 feet), purely for business, not for exhibition of goods, can be had for £3, 10s. to Members and £5 to Non-Members. Intimation to be made to the Secretary on or before the 18th of June. Those applying after that date to pay double Entry Money, but no application can be received later than 6th July.

Lights and Smoking. 8. No lights allowed in the Yard at night, and Smoking is strictly prohibited within the Sheds. Those infringing this Rule shall be liable to a fine of 10s.

Water. 9. As the command of water in the Yard is limited, it is particularly requested that waste be avoided.

Restoring Turf. 10. When the ground requires to be broken, the turf must be carefully lifted and laid aside, and the surface must be restored to the satisfaction of the Society, and at the expense of the Exhibitor.

Subjection to Rules. 11. All persons admitted into the Showyard shall be subject to the Rules and Orders of the Directors.

Powers of Stewards. 12. The Stewards have power to enforce the Regulations of the Society in their different departments, and to bring to the notice of the Directors and Secretary any infringement thereof.

Attendants. 13. All persons in charge of Stock or other Exhibits shall be subject to the orders of the Secretary and Stewards.

Violation of Rules. 14. The violation by an Exhibitor of any one of the Regulations shall render him liable to the forfeiture of all Premiums awarded to him, or of such a portion as the Directors may ordain.

Railway Passes. 15. Railway Passes for unsold Stock and Implements must be applied for at the Committee Room in the Yard between 9 and 11 o'clock on the forenoon of Thursday and Friday.

Closing of Show. 16. The Show terminates at 5 P.M. on Friday, 27th July, and no animal or article can be withdrawn before that hour; Steam Engines not till 6 o'clock. Stock and Implements may remain in the Yard till Saturday afternoon.

Payment of Prizes. 17. The Premiums awarded will be paid in November 1894, and, with the exception of the Tweeddale Gold Medal, Special Challenge Cups, and the Silver Medals, may be taken either in money or in plate.

STOCK AND POULTRY.

18. Poultry and Stock will be admitted on Monday, the day before the opening of the Show, and, with the exception of Horses, must be in the Yard before 12 o'clock that night. Horses must be in before 8 o'clock on the morning of Tuesday, except those entered for Jumping only, regarding which special Regulations will be found beside the list of prizes for Jumping. Judging begins at 10 A.M. on Tuesday. Exhibited on Tuesday, Wednesday, Thursday, and Friday. Stock may be admitted on the Saturday preceding the Show, but only by sending two days' prior notice to the Secretary. *Admission of Stock.*

19. An animal which has gained a first Premium at a General Show of the Society cannot again compete in the same class, but may be exhibited as Extra Stock. *Former Winners.*

20. All animals, except calves, foals, and lambs shown with their dams, must be entered in the classes applicable to their ages, and cannot be withdrawn after entry, or other animals be substituted in their place. *No substitution of animals.*

21. For prizes given by the Society, no animal shall be allowed to compete in more than one class, except in the Jumping and Driving Competitions. *One class only.*

22. Shorthorn, Aberdeen-Angus, and Galloway animals must be entered in the herd-books, or the Exhibitor must produce evidence that his animal is eligible to be entered therein. *Herd-books.*

23. Stock must be *bona fide the property of* the Exhibitor on the last day of Entry. *Ownership.*

24. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor. The Society shall have power at any time to call upon an Exhibitor to furnish proof of the correctness of any statement in his entry.

25. The name of the Breeder, if known, must be given, and if the Breeder is not known, a declaration to that effect, signed by the Exhibitor, must be sent along with the Schedule, and no pedigree will be entered in the Catalogue when the Breeder is unknown. *Particulars of entries.*

26. Should it be proved to the satisfaction of the Directors that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Directors or Judges as to its qualification or properties, or that information required in the Schedule and known or easily ascertained by the Exhibitor has been withheld, such animal may be disqualified either before or after a prize has been awarded to it, and the case may be reported to the Directors, in order that the Exhibitor may be disqualified from again competing at the Society's Shows, or his case otherwise disposed of as the Directors may determine. *Entries disqualified.*

27. When an animal has previously been disqualified by the decision of any Agricultural Association in the United Kingdom, such disqualification shall attach, if the Exhibitor, being aware of the disqualification, fail to state it, and the grounds thereof, in his entry, to enable the Directors to judge of its validity. Any person who is disqualified from exhibiting at any Show in the United Kingdom shall be prohibited from exhibiting at any General Show of the Society, unless with the special consent of the Board.

28. All Horses or Ponies entered in classes in which a particular height is stated shall before being judged be measured with their shoes on. No subsequent measuring or alteration of shoes will be permitted. *Height of Horses.*

29. Breeding Stock must not be shown in an improper state of fatness, and the Judges are requested not to award Premiums to overfed animals; and no Cattle or Sheep which have been exhibited as Fat Stock at any Show are eligible to compete in the Breeding Classes for the Society's Prizes. *Overfeeding.*

30. Horses and Cattle must be paraded at the times stated in the Programme of the Show, and when required by the Stewards, and under their direction. Prize and commended animals will receive two rosettes each, *Parades.*

which must be attached to the head of the animal, one on each side. Attendants must be beside their animals *twenty minutes before the hour of Parade*, and be ready to proceed to the ring immediately on receiving the order of the Stewards.

Responsibility of Exhibitors. 31. Exhibitors shall be answerable for all acts, whether committed by themselves, their servants, or others in charge of their Stock, and shall be responsible for the condition of their animals during the whole time they remain in the Showyard.

Authority for removal. 32. No animal shall be taken out of its stall after 10 A.M. during the Show except by order of the Stewards, or with permission of the Secretary. Those infringing this Rule shall be liable to a fine of 10s.

Sires. 33. Aged Bulls and Stallions must have had produce, and, along with Two-year-old Bulls, Three-year-old Colts, and two Shear and aged Tups, have served within the year of the Show.

Cows. 34. All Cows must have had calves previous to the Show, and when exhibited they must either be in milk or in calf: if in milk, birth must have been within 9 months of the Show; if in calf, birth must be certified within 9 months after the Show. This Rule does not apply to animals in Family Groups. Ayrshire Heifers in calf must produce a calf within one month of the first day of the Show.

Family Groups. 35. Cows in Family Groups must have had calves previous to the Show, and when exhibited they must be either in milk or in calf. Two-year-old Heifers in Family Groups must be certified to have been served before the Show, except Highland Heifers, which need not be served till 3 years old.

Ayrshire Cows. 36. All Milk Cows of the Ayrshire breed must be in the Yard on the evening of Monday, the day before the opening of the Show, before 8 o'clock, after which they will be inspected by the Veterinary Surgeon, or other official of the Society, between 8 and 9 o'clock, to see if they have been milked dry; and if not, they must be milked under his direction, and, after the judging, all Milk Cows must be milked morning and evening.

Tampering with animals. 37. Any artificial contrivance or device of any description found on or proved to have been used on an animal, either for preventing the flow of milk or for any other improper purpose, will disqualify that animal from being awarded a Premium, and the Owner of said animal shall be prohibited from again entering Stock for any of the Society's General Shows, or for such a period as the Directors may see fit.

In-calf Heifers. 38. Two-year-old Heifers—of the Shorthorn, Aberdeen-Angus, and Galloway breeds—must be in calf when exhibited, and the Premiums will be withheld till birth be certified, which must be within 9 months after the Show. This Rule does not apply to animals in Family Groups.

39. Animals of any age that have had a calf must be shown as Cows.

Mares. 40. Agricultural Mares with foal at foot must have produced foals after 1st January 1894. In the case of a Mare whose foal has died, she shall without further entry be eligible to compete among the Yeld Mares. Agricultural Yeld Mares must produce a foal within 12 months from the first day of the Show.

Calves and Foals. 41. With reference to Regulations 34 and 38, birth of at least a seven months' calf must be certified; and in regard to Regulation 40, birth of at least a nine months' foal.

Concealing animals. 42. No rug shall be hung up so as to conceal any animal in a horse-box or stall, except with special permission of the Steward of that department.

Hunters. 43. Horses entered as Hunters must be jumped if required by the Judges.

Soundness of Horses. 44. Judges are particularly requested to satisfy themselves, as far as possible, regarding the soundness of all Horses before awarding the Prizes, and to avoid giving a preference to animals showing symptoms of hereditary diseases. The Judges may consult the Society's Veterinary Surgeon if they deem it expedient. No protests on veterinary grounds will be received.

Ewes. 45. All Ewes must have reared lambs in the year of the Show; and

Ewes of the Blackfaced and Cheviot breeds must be in milk, and have their lambs at foot.

46. Sheep must have been clipt bare after 1st January of the year of the Show, and the Judges are instructed to examine the fleeces of the Sheep selected for Prizes, and to cast those on which they find any of the former fleece. *Clipping.*

47. Sows must have reared pigs in the year of the Show or be in pig; and Pigs must belong to the same litter, and be uncut. *Sows.*

48. In Poultry the Aged Birds must have been hatched previous to, and Cockerels and Pullets in, the year of the Show. *Poultry.*

49. Bulls must be secured by nose-rings, with chains or ropes attached, or with strong halters and double ropes. All Cattle must be tied in their stalls. *Securing Cattle.*

50. Servants in charge of Stock must bring their own buckets or pails, and a piece of rope or sheep-net to carry their forage. Mangers, sheep and pig troughs, will be provided. *Feeding appliances.*

51. Loose-boxes will be provided for Stallions, Three, Two, and One year-old entire Colts and Fillies, and for Mares with foals at foot; closed-in stables for all the other Horses, and covered accommodation for the whole of the other Live Stock. Stalls for attendants on Cattle and Horses and closed-in accommodation for Shepherds will be provided at same rates as those charged for Stock (see page 64). The accommodation for Shepherds will be placed at the ends of the Sheds for Sheep. *Accommodation for animals.*

52. Five days' supply of straw, hay, grass, and tares will be provided free by the Society. Any additional fodder or other kinds of food required will be supplied at fixed prices in the Forage-yard. Any servant removing bedding from an adjoining stall will be fined in double the amount taken. Exhibitors may fetch their own cake or corn to the Yard, but not grass, tares, hay, or straw. Coops, food, and attendance for Poultry will be provided by the Society. *Fodder.*

53. Cattle, Sheep, Swine, or Poultry cannot be removed from the Yard till 5 P.M. on Friday, the last day of the Show, except on certificate by the Veterinary Surgeon employed by the Directors, countersigned by the Steward of the department and the Secretary. *Removal.*

54. Horses may be withdrawn at 6 o'clock on Tuesday evening, and at 8 o'clock on Wednesday and Thursday evenings, on a deposit of £5 for each animal, which shall be forfeited, along with any prize-money it may have gained, if the animal is not brought back. They must return between 7 and 7.30 the following morning, and those not in before 8 shall forfeit 10s. Horse passes to be applied for at the Committee Room between 5 and 6 P.M. on Tuesday, and the deposit, unless forfeited in whole or in part, will be returned between 12.30 and 2.30 on Friday. *Withdrawal of horses over night.*

55. When the Stock is leaving the Yard, no animal is to be moved till ordered by those in charge of clearing the Yard. Those transgressing this Rule shall be liable to a fine of 10s., and detained till all the other Stock is removed. *Order in removal.*

JUDGING STOCK AND POULTRY.

56. On Tuesday, the first day of the Show, no person will be admitted, except Servants in charge of Stock, till 8 A.M., when the Gates are opened to the public. *Opening Gates.*

57. The Judges will commence their inspection at 10 A.M. The spaces reserved for the Judging will be enclosed, and no encroachment shall be permitted. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit; and where only one or two lots are presented in a section, and the Judges consider them unworthy of the Premiums offered, it shall be in their power to award a lower prize, or to suggest the removal of any lot which appears to them unworthy of a place in the Yard. *Judging.*

Commendations. 58. In addition to the Premiums, the Judges are authorised to award three Commendations in each section (except Poultry, where only two Prizes and one Commendation are to be awarded), if the entries are numerous and the animals of sufficient merit. These Commendations consist of—Very Highly Commended, Highly Commended, and Commended.

Ayrshire Cows and Heifers. 59. Ayrshire Cows which have not calved before the Show, whether entered in the class for Cows in Milk or for Cows in Calf, shall be judged along with the Cows in Calf, and Ayrshire Cows or Heifers which have calved before the Show—in whichever of the two classes entered—shall be judged along with Cows in Milk.

Attending Members. 60. One Member of Committee and one or two Directors shall attend each section of the Judges. It will be their duty to bring the animals out to the Judges and to see that no obstruction is offered to them, and that the space reserved for them is not encroached upon; to ticket the prize animals; to send the Nos. of prize animals to the Award Lectern; to assist the Judges in completing their return of awards; and should any difficulty arise, to communicate with the Stewards or Secretary.

61. It shall not be competent for any Exhibitor, nor for his Factor or Land-Steward, to act as a Judge or attending Member in any class in which he is competing.

DAIRY PRODUCE.

62. Dairy Produce will be received in the Showyard on Monday, the day before the opening of the Show, and till 8 A.M. on Tuesday, the first day of the Show. Judged at 10 A.M. on Tuesday. Exhibited Tuesday, Wednesday, Thursday, and Friday.

63. Dairy Produce must have been made on the Exhibitor's farm this year. No Exhibitor shall show more than one lot in each class. At least 1 cwt. of the variety of Butter exhibited must have been made during the Season. The lots must be fair samples. No lot can be removed from the Yard till 5 P.M. on Friday, the last day of the Show. The Society undertakes no responsibility for the receipt or despatch of exhibits.

STALL RENT.

64. The following rates shall be paid by Exhibitors when making their Entries[1]:—

	Members. s.	d.	Non-Members. s.	d.
Cattle, each	15	0	25	0
Boxes for Stallions—3 and 2 year-old entire Colts, and Mares with Foals at foot	30	0	40	0
Boxes for one-year-old entire Colts	20	0	30	0
Stallions, 12 hands and under	15	0	20	0
Mares or Geldings, 12 hands and under	10	0	15	0
All other Horses, each	20	0	30	0
Sheep, per pen	10	0	15	0
Swine, per pen	15	0	20	0
Poultry, each entry	3	0	5	0
Dairy Produce, each entry	4	0	6	0
Stalls for Attendants and Stalls for Shepherds at the ends of Sheep-pens, same rates as above.				
Covered Booths for offices, 9 feet by 9 feet	70	0	100	0
Newspaper offices . . £2, 10s.				

[1] In the case of cattle, horses, sheep, or swine entered in more than one class, the entry fee shall be five shillings for each class after the first. This does not apply to the Jumping Competitions.

FINES FOR STOCK NOT FORWARD.

65. In order to lessen the number of vacant Stalls, the following fines shall be imposed on all Exhibitors whose animals are not forward : For Horses, 40s.; Cattle, 20s.; Sheep and Swine, 10s.; Poultry, 3s.;—this fine to be in addition to Entry Money. In the case of death or illness of an animal, a Veterinary Surgeon's Certificate is necessary for a remit of the fine. The absent animals must be reported by the Stewards to the Secretary.

EXTRA STALL FOR ATTENDANTS.

66. Exhibitors of Stock shall be entitled to take an extra Stall for the accommodation of their attendants without being liable to a fine, but they must state when making their Entry that the Stall is to be used for that purpose, and remit rent. Accommodation for Shepherds will be placed at the ends of the Sheds for Sheep.

IMPLEMENTS AND OTHER ARTICLES.

67. Implements will be received in the Yard from Tuesday, 17th July, till 5 o'clock on the afternoon of Monday, 23d July. Exhibited Tuesday, Wednesday, Thursday, and Friday. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor, and prices must be stated. *Admission.*

68. No Money Prizes or Medals will be given by the Society for Implements of any kind. *Premiums.*

69. Agricultural Implements, and Implements and collections of articles not Agricultural, will be received for Exhibition, but the Secretary is entitled to refuse Entries from dealers in articles not deemed worthy of Exhibition. *Refusing Entries.*

70. In order to encourage exhibits of Agricultural Implements from operative Blacksmiths and Carpenters in the district of the Show, open space will be provided for these in some less prominent part of the Yard at a charge of Entry Money of 1s. per running foot of frontage, 20 feet deep. *Local Operatives.*

71. Implements will be entered in the following sections—viz., 1st, Under Cover, for Agricultural Implements; 2d, Open, for Agricultural Implements; 3d, Exhibits not Implements of Husbandry, either under cover or open, as may be deemed necessary by the Secretary; 4th, Motion Yard; 5th, Open space for Agricultural Implements from operative Blacksmiths and Carpenters in the district of the Show. Exhibitors must specify the space they require. *Order of Implements.*

72. The articles of each Exhibitor must be all placed in one stand, except Implements in motion, and must not on any account extend beyond the width allowed. No article shall be moved out of its stand, or the stand dismantled, till the termination of the Show, at 5 P.M. on Friday. Those infringing this Rule shall be liable to a fine of 10s. *Placing Exhibits.*

73. Exhibitors must arrange their own articles *within* the space allotted to them before 9 o'clock on Tuesday, and to the satisfaction of the Stewards in charge of the Implement Yard. *Arranging Exhibits.*

74. All Machines requiring steam or fire must be entered as such in the Certificate, and will be placed in the Motion Yard. *Coke only shall be used in all cases where fire is required after* 10 *o'clock* A.M. Those infringing this Rule shall incur a penalty of £5. *Fuel.*

75. No Steam Engine shall be driven in the Yard at a greater speed than 4 miles an hour. *Steam Engines.*

76. Locomotive and Traction Engines and other Machines must not be moved from their places without permission of the Secretary or Stewards, and must not leave their stands till 6 P.M. on Friday.

Consigning Implements. 77. There must be attached to each Implement, when forwarded to the Show, a label bearing the Exhibitor's name, and that of the Implement, as well as the number of the Exhibitor's stand.

78. The carriage of all Implements must be prepaid.

STALL RENT.

79. Ground to be taken in spaces of 10 feet frontage by 20 feet deep, except in Motion Yard, which is to be 10 feet or any larger amount of frontage by 50 feet deep. Except for exhibits not agricultural, no boarding shall exceed 4 feet in height.

80. The following rates shall be paid by Exhibitors when making their Entries :—

	Members.	Non-Members.
Implement Shedding, 20 feet deep, 7 feet high, per 10 feet	£1 5 0	£1 15 0
Implements without Shedding, 20 feet deep, per 10 feet	1 5 0	1 15 0
Implement space in Motion Yard, without Shedding, 50 feet deep, per foot . .	0 2 6	0 3 6
And with Shedding, 20 feet deep, 10 feet high, per foot	0 6 0	0 8 0
Covered Booths for offices, 9 feet by 9 feet, each	3 10 0	5 0 0
Newspaper offices, each . . £2, 10s.		

ADMISSION OF THE PUBLIC.

Particulars as to hours of Admission and Charges in a later edition of the Prize List.

ADMISSION OF MEMBERS AND EXHIBITORS.

On exhibiting their "*Member's Ticket,*" which is strictly not transferable, Members of the Society are admitted free to the Showyard and to the Enclosures and Stands around the Large Ring, excepting the Centre Seats in the Grand Stand, and such other parts as may be reserved for any special purpose. Tickets will be sent to all Members residing in the United Kingdom whose addresses are known, and on no account will duplicates be issued. All Members not producing their tickets must pay at the gates, and the admission money will not on any account be returned.

Exhibitors of Stock (not Members) are admitted free to the Showyard on producing their tickets.

Exhibitors of Implements (not Members) and their attendants will be entitled to free entry to the Showyard during the Show.

Tickets for attendants on Stock and Implements are not available to admit to the Yard between 11 A.M. and 5 P.M.; and any attendant requiring to leave the Yard during the day cannot be again admitted except by a special pass (to be applied for at the Ticket Gate), which must be given up on his return.

Placards, except those of the Society, are prohibited both inside the Showyard and on the outside of the Boundary Fence, with the exception

of those belonging to Exhibitors, whose right is confined to their own stalls. No newspapers or any other article allowed to be carried about the Yard for sale or display. No strolling bands or musicians admitted.

No Carriages or Equestrians admitted without special leave from the Directors, and then only for Invalids. Bath-chairs may be brought in.

Premium Lists, Regulations, and Certificates of Entry may be obtained by applying at the Secretary's Office, No. 3 George IV. Bridge, Edinburgh.

All Communications should be addressed to James Macdonald, Esq., *Secretary of the Highland and Agricultural Society of Scotland, No. 3 George IV. Bridge, Edinburgh.*

Address for Telegrams—"Society," Edinburgh.

LAST DAYS OF ENTRY.

Implements and other Articles—Monday, 21st May.

Stock, Poultry, and Dairy Produce—Monday, 18th June.

No Entry at ordinary fees taken later than those which are received at the Society's Office, Edinburgh, by first post, or 10 o'clock, on Monday morning (18th June). Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (20th June), at the Society's Office, Edinburgh, at 10 o'clock.

Covered Booths for Offices—Monday, 18th June.

RAILWAY ARRANGEMENTS.

The Railway Companies will be furnished with a list of the Exhibitors of Stock and Implements, after the 5th of July, and all applications for horse-boxes and trucks, and for information as to arrangements of Special Trains, must be made by the Exhibitors themselves with the Station-master where their stock is to be trucked.

The arrangements made by the Railway Companies for the conveyance of live Stock and Goods to and from the Show are indicated in the following, but exhibitors are recommended to apply to the respective companies for full particulars:—

1. Live Stock and Goods *to* the Show to be charged ordinary rates.

2. Live Stock and Goods *from* the Show, *if sold,* to be charged ordinary rates.

3. Live Stock and Goods *from* the Show, *if unsold,* to be conveyed at half rates back to the station whence they were sent, at owners' risk, on production of a certificate from the Exhibitor or the Secretary of the Show to the effect that they are unsold; failing production of such certificate, ordinary rates must be charged. The reduction to half rate is to be allowed only when the animals or goods are returned by the same route as that by which they were conveyed *to* the Show. The minimum charge for Stock returned at half rates is one-half the ordinary minimum.

If the unsold Live Stock which was conveyed on the outward journey by Passenger Train in horse-boxes be required to be returned by Goods Train in cattle trucks, half the Goods Train rates must be charged.

If the unsold Live Stock which was conveyed on the outward journey by Goods Train in cattle trucks be required to be returned by Passenger Train in horse-boxes, half the Passenger Train rates must be charged.

4. Unsold Live Stock transferred from one Agricultural Show to another, in another part of the country, must be charged ordinary rates.

5. Unsold goods transferred from one Agricultural Show to another, in another part of the country, will be conveyed at half rates at owners' risk, on production of Certificate from the Exhibitor or the Secretary of the Show to the effect that they are unsold; failing production of such certificate, ordinary rates will be charged.

6. Poultry and Dogs to be charged ordinary rates both ways.

7. Horse-boxes, or other Passenger Train vehicle, must not be provided for the carriage of Live Stock sent by Goods Train and invoiced at Goods Train rates. For rates for Horse-boxes by Passenger and Special Trains, apply to the Railway Companies.

8. Provender conveyed to Agricultural Shows with Live Stock is to be charged ordinary rates, except so much of the same as may be required on the journey.

9. Men, certified by the owners to be *bona fide* in charge of Live Stock, to be conveyed free in the same train as the animals; one man to each consignment, or one to each vehicle if the consignment occupy more than one vehicle.

10. The ordinary rates do not include delivery *to*, or collection *from*, the Show Ground.

11. Agricultural Societies' Show Plant must be charged at Class C rates, station to station.

12. Tents, Canvas, and other articles carried to Shows, not for exhibition, to be charged the ordinary rates both going and returning.

DELIVERY CHARGES.

Rates of Cartage for Delivery and Collection of Live Stock, Implements, and other Articles between the Railway Stations in Aberdeen and the Show-yard.

1. General traffic, 3s. per ton (minimum per consignment, 1s. 6d.)
2. Implements and Machinery (Agricultural), not exceeding 1 ton each, 4s. per ton (minimum per consignment, 2s.)
3. Implements and Machinery (Agricultural), on their own wheels (specially hauled), not exceeding 1 ton, 4s. each.
4. Single articles, exceeding 1 ton, but not exceeding 3 tons, 4s. 6d. per ton.
5. Single articles, exceeding 3 tons, but not exceeding 5 tons, 6s. 6d. per ton.
6. Single articles, exceeding 5 tons, 8s. 6d. per ton.
7. Carriages, four-wheeled, 5s. each.
8. Carriages, two-wheeled, 4s. each.
9. Cattle, in floats, 3s. 6d. per head (minimum charge, 5s.)
10. Sheep and Pigs, in floats, 1s. per head (minimum charge, 3s. 6d., and maximum charge, 5s. for each float).

The rates charged for carriage do not in any case include collection or delivery.

The carriage of all Live Stock, Implements, and other articles for exhibition at the Show must be prepaid.

CHAMPION MEDALS GIVEN BY H.R.H. THE DUKE OF YORK, K.G.

A Champion Bronze Medal is given by H.R.H. The Duke of York, K.G., President of the Society, for the *best Animal or pen* in each of the following sections :—

		Classes			Classes
1.	Shorthorn	1 to 6	11.	Roadsters	52 to 55
2.	Aberdeen-Angus	7 to 13	12.	Hackneys	57 to 64
3.	Galloway	14 to 19	13.	Ponies	67 to 71
4.	Highland	20 to 25	14.	Shetland Ponies	72 to 74
5.	Ayrshire	26 to 32	15.	Blackfaced Sheep	75 to 81
6.	Fat Cattle	33 to 38	16.	Cheviot	82 to 85
7.	Clydesdale Stallions	39 to 42	17.	Border Leicester	86 to 89
8.	Clydesdale Mares and Fillies	43 to 47	18.	Shropshire	90 to 93
9.	Draught Geldings	48 to 50	19.	Fat Sheep	94 to 99
10.	Hunters	51	20.	Swine	100 to 108

CATTLE

SHORTHORN.

Class		Premiums. 1st. £	2d. £	3d. £
1.	Bull calved before 1st Jan. 1892	15	10	5
2.	Bull calved in 1892	15	10	5
3.	Bull calved in 1893	12	8	4
	[1] Best Bull of any age in the three Classes —£20.			
	Breeder of Best Bull of any age in the three Classes,—The Silver Medal.			
4.	Cow of any age	12	8	4
5.	Heifer calved in 1892	10	5	3
6.	Heifer calved in 1893	10	5	3

Duke of York's Medal for best Shorthorn.

Carry forward ———— £144

ABERDEEN-ANGUS.

[2] Two Silver Cups, each of the value of £50, for the best Bull of any age and for the best Cow of any age (Heifers excluded) in the Aberdeen-Angus cattle classes. These are to be Challenge Cups, and are to be known as the "Ballindalloch Challenge Cups." They are offered under the following conditions: 1. The Directors shall assume charge of the Cups, and shall frame such rules for their safety as they may decide upon. 2. Each Cup shall be held by the winner for one year as a Challenge Cup, and shall become the property of the exhibitor who shall win it five times, not necessarily in succession. 3. The Society shall, at their own expense, cause to be engraved on each Cup each year, the year, the place of the Show, name of successful exhibitor, name and herd-book number of the animal, and name of its breeder. 4. The Society shall award to the breeder of the successful animals a Silver Medal, bearing that he is the breeder of the winner of the "Ballindalloch Challenge Cup." 5. In every other respect the Cups shall be won according to regulations which the Directors may from time to time enact.

[1] Given by the Shorthorn Society. [2] Given by Mr Macpherson Grant of Drumduan.

Brought forward £144

Class	ABERDEEN-ANGUS—*continued.*	Premiums. 1st. £	2d. £	3d. £	
7.	Bull calved before 1st Dec. 1891 . .	15	10	5	
8.	Bull calved on or after 1st Dec. 1891 .	15	10	5	
9.	Bull calved on or after 1st Dec. 1892 .	12	8	4	
	[1] Champion Cup, value £50, for the best Bull of any age in the three Classes (see above).				
	[2] Best Bull in the three Classes,—Gold Medal, value £8, 10s.				
	Breeder of best Bull of any age in the three Classes,—The Silver Medal. . . .				
10.	Cow calved before 1st Dec. 1890 . .	12	8	4	
11.[1]	Cow calved on or after 1st Dec. 1890—£12, £8, £4.				
	[1] Champion Cup, value £50, for the best Cow of any age in the two Classes (see above).				
	Breeder of best Cow of any age in the two Classes,—The Silver Medal.				
12.	Heifer calved on or after 1st Dec. 1891 .	10	5	3	
13.	Heifer calved on or after 1st Dec. 1892 .	10	5	3	
	[2] Best Female Animal in the four Classes,—Gold Medal, value £8, 10s.				
	[3] Best Heifer in Classes 12 and 13—£10.				144
	Duke of York's Medal for best Aberdeen-Angus Animal.				
	GALLOWAY.				
14.	Bull calved before 1st Jan. 1892 . .	15	10	5	
15.	Bull calved in 1892 . . .	15	10	5	
16.	Bull calved in 1893 . . .	12	8	4	
	Breeder of Best Bull of any age in the three Classes,—The Silver Medal.				
17.	Cow of any age	12	8	4	
18.	Heifer calved in 1892 . . .	10	5	3	
19.	Heifer calved in 1893 . . .	10	5	3	
	Duke of York's Medal for best Galloway.				144
	HIGHLAND.				
20.	Bull calved before 1st Jan. 1892 . .	15	10	5	
21.	Bull calved in 1892 . . .	15	10	5	
22.	Bull calved in 1893 . . .	12	8	4	
	Breeder of best Bull of any age in the three Classes,—The Silver Medal.				
23.	Cow of any age	12	8	4	
24.	Heifer calved in 1891 . . .	10	5	3	
25.	Heifer calved in 1892 . . .	10	5	3	
	Duke of York's Medal for best Highland Animal.				144

Carry forward £576

[1] Given by Mr Macpherson Grant of Drumduan.
[2] Given by the Polled Cattle Society.
[3] Given by Mrs Morrison Duncan of Naughton.

Brought forward £576

Class	AYRSHIRE.	Premiums. 1st. £	2d. £	3d. £	
26.	Bull calved before 1st Jan. 1892	15	10	5	
27.	Bull calved in 1892	12	8	4	
28.	Bull calved in 1893	8	5	3	
	Breeder of Best Bull of any age in the three Classes,—The Silver Medal.				
29.	Cow in Milk, any age	10	7	3	
30.	Cow of any age in Calf, or Heifer calved in 1891 in Calf and due to calve within one month of the first day of the Show	10	7	3	
31.	Heifer calved in 1892	10	5	3	
32.	Heifer calved in 1893	8	5	3	
	Duke of York's Medal for best Ayrshire.				144

Class	FAT CATTLE.	1st. £	2d. £	
33.	Aberdeen-Angus or Galloway Ox calved after 1st Dec. 1891	5	2	
34.	Aberdeen-Angus or Galloway Ox calved after 1st Dec. 1892	5	2	
35.	Ox of any other pure breed or cross calved after 1st Dec. 1891	5	2	
36.	Ox of any other pure breed or cross calved after 1st Dec. 1892	5	2	
37.	Heifer of any pure breed or cross calved after 1st Dec. 1891	5	2	
38.	Heifer of any pure breed or cross calved after 1st Dec. 1892	5	2	
	Duke of York's Medal for best Fat Animal.			42

£762

HORSES

FOR AGRICULTURAL PURPOSES.

CAWDOR CHALLENGE CUP, VALUE 50 GUINEAS, FOR BEST MARE.

Conditions of Competition.—1. These Cups are, through the kindness of the Right Honourable the Earl Cawdor, President for the year 1891-92, offered by the Clydesdale Horse Society of Great Britain and Ireland—one for the best Clydesdale Stallion or Entire Colt registered in the Clydesdale Stud-Book, and the other for the best Clydesdale Mare or Filly registered in the Clydesdale Stud-Book, entered in any of the Draught Horse classes, at the show or shows at which they may be competed for. 2. The Council of the Clydesdale Horse Society shall, at a meeting held not later than the month of August in any year, decide at what show or shows the "Cawdor Challenge Cups" shall be competed for in the year immediately following. 3. Either of these Cups must be won three times by an exhibitor (but not necessarily in consecutive years or with the same animal) before it becomes

his absolute property; and immediately after an award has been made, and official notification thereof has been received by the Secretary of the Clydesdale Horse Society from the Secretary of the Society under whose auspices the competition has taken place, the name of the winner, and of the animal with which the Cup has been won, will be engraven on the Cup. 4. The winner of either of the Cawdor Challenge Cups, other than the absolute winner, shall, before delivery thereof is made to him, give security to the Clydesdale Horse Society that he shall surrender the same to the Society and deliver it at the Society's office when called upon to do so. 5. Until the Cup or Cups be won outright, the winner of either Challenge Cup will receive the Clydesdale Horse Society's Silver Medal as a memento of his winning the Cup; and the said Medal shall bear an inscription specifying the show at which, the date on which, and the name of the animal with which the Challenge Cup has been won, as well as the name of the owner. In name of the Council of the Clydesdale Horse Society, and as approved, first, by its Committee, Messrs R. Sinclair-Scott, John M. Martin, and James Park, and finally, by the Right Hon. the Earl Cawdor, its President.

ARCHD. MACNEILAGE, *Secretary.*

For the above Cup all former prize animals at the Society's Shows, now disqualified from competing in the ordinary classes, are permitted to compete. The Clydesdale Horse Society to have the option of photographing the winner for publication in the Clydesdale Stud-Book.

	Premiums. 1st.	2d.	3d.	4th.
Class	£	£	£	£
39. Stallion foaled before 1st Jan. 1891	15	12	8	4
40. Entire Colt foaled in 1891 . .	15	12	8	4
41. Entire Colt foaled in 1892 . .	15	10	6	3
42. Entire Colt foaled in 1893 . .	12	7	4	2
[1] Best Stallion in the foregoing Classes,—Champion Premium of £10.				
Breeder of Best Male Animal of any age in the four Classes,—The Silver Medal.				
Duke of York's Medal for best Clydesdale Stallion.				
43. Mare of any age, with Foal at foot .	15	10	5	3
44. Yeld Mare foaled before 1st Jan. 1891	10	6	3	2
45. Filly foaled in 1891 . .	10	6	3	2
46. Filly foaled in 1892 . .	10	6	3	2
47. Filly foaled in 1893 . .	10	6	3	2
Best Mare or Filly registered in the Clydesdale Stud-Book,—Cawdor Challenge Cup, value 50 Guineas (see p. 71).				
Duke of York's Medal for best Clydesdale Mare or Filly.				

Carry forward ——————— £254

No animal is allowed to compete in more than one Class, except in the Jumping and Driving Competitions.

[1] Given by Mr Lockhart, Mains of Airies.

	Premiums. 1st.	2d.	3d.	
Brought forward				£254
DRAUGHT GELDINGS.				
Class	£	£	£	
48. Draught Gelding foaled before 1st Jan. 1891 . . .	8	4	2	
49. Draught Gelding foaled in 1891 .	8	4	2	
50. Draught Gelding foaled in 1892 .	5	3	2	
Duke of York's Medal for best Draught Gelding.				38
ROAD OR FIELD.				
51. Hunter, Mare or Gelding, foaled before 1st Jan. 1891—*in saddle* .	10	5	3	
Duke of York's Medal for best Hunter.				
52. Mare or Gelding, foaled before 1st Jan. 1891, 15 hands and upwards —*in saddle* . . .	8	4	2	
53. Mare or Gelding, foaled before 1st Jan. 1891, 14.2, and under 15 hands—*in saddle* . .	8	4	2	
54. Mare or Gelding foaled in 1891—*in hand*	6	4	2	
55. Mare or Gelding foaled in 1892—*in hand*	6	4	2	
Duke of York's Medal for best Roadster.				
56.[1] Colt or Filly foaled in 1893, the produce of thoroughbred Stallions, out of Mares of any breed,—Five Prizes, £10, £7, £5, £2, £1. .				70
HACKNEYS. (*All to be shown in hand.*)				
57. Stallion any age over 14.2 hands .	10	5	2	
58. Brood Mare, 15 hands and upwards, with Foal at foot, or to foal this season to a registered Sire .	7	4	2	
59. Brood Mare, under 15 hands, with Foal at foot, or to foal this season to a registered Sire . .	7	4	2	
All animals entered in Classes 57, 58, and 59 must be registered in the Hackney Stud-Book.				
60. Filly, foaled in 1891 . .	5	3	1	
61. Filly, foaled in 1892 . .	5	3	1	
62. Filly, foaled in 1893 . .	5	3	1	
All animals entered in Classes 60 to 62 inclusive must be got by registered Hackney Sires.				
Carry forward	39	22	9	£362

No animal is allowed to compete in more than one Class, except in the Jumping and Driving Competitions.

[1] Given by Mr Gilmour of Montrave.

Class		Premiums. 1st.	2d.	3d.	
	Brought forward				£362
	HACKNEYS—*continued.*	£	£	£	
	Brought forward	39	22	9	
63.	Entire Colt, foaled in 1892, Registered in Hackney Stud-Book .	5	3	1	
64.	Entire Colt, foaled in 1893, eligible for entry in Hackney Stud-Book	5	3	1	
	[1] Prize of £10 and Bronze Medal by Hackney Horse Society for best Mare or Filly in Hackney or Pony Classes.				88
	Duke of York's Medal for best Hackney.				
	The Scotch Committee of the Hackney Horse Society gives £44 towards the above Prizes for Hackneys.				
	DRIVING COMPETITIONS.				
65.	Best Turn-out of single Horse, Harness, and Trap, to be driven in the ring, 15 hands and upwards .	8	4	2	
66.	Best Turn-out of single Horse, Harness, and Trap, to be driven in the ring, under 15 hands .	8	4	2	
					28
	PONIES.				
67.	Stallion, over 12, not exceeding 14.2 hands	4	2	1	
68.	Mare or Gelding, between 13 and 14½ hands . . .	4	2	1	
69.	Mare or Gelding, between 12 & 13 hands	4	2	1	
70.	Stallion, under 12 hands . .	4	2	1	
71.	Mare or Gelding, under 12 hands .	4	2	1	
	Duke of York's Medal for best Pony.				35
	SHETLAND PONIES.				
72.	Stallion, above 3 years, not exceeding 10½ hands . . .	4	2	1	
73.	Mare or Gelding, above 3 years, not exceeding 10½ hands . .	4	2	1	
74.	Mare or Gelding, under 3 years old, not exceeding 10½ hands .	4	2	1	
	Duke of York's Medal for best Shetland Pony.				21
					£534

JUMPING COMPETITIONS—*See page 77.*

No animal is allowed to compete in more than one Class, except in the Jumping and Driving Competitions.

[1] A Mare 6 years old or more must have had a foal. Winners of the Hackney Society's Medals in 1894, except at the London and Royal English Shows, excluded. The winner must be entered or accepted for entry in Hackney Stud-Book, and certified free from hereditary disease.

SHEEP

	Premiums. 1st.	2d.	3d.	
BLACKFACED.				
Class	£	£	£	
75. Tup three shear or upwards . .	10	5	3	
76. Tup two shear	10	5	3	
77. Shearling Tup	10	5	3	
78. [1] Five Shearling Tups, bred and fed by Exhibitor, the Tups to be offered for *bona fide* sale, and sold without reserve at any of the following Ram sales in 1894—viz., Ayr, Edinburgh (Lothian Ram Sales), Glasgow, Lanark, Oban, or Perth—The Ayrshire Plate of 40 Sovereigns.				
[2] Champion Prize of £10 for Best Ram in foregoing classes.				
79. Three Ewes above one shear, with their Lambs at foot . .	8	4	2	
80. Three Shearling Ewes or Gimmers .	8	4	2	
[3] Champion Prize of £10 for Best Pen of Blackfaced Ewes or Gimmers in the foregoing classes.				£82

81. [4] Tup Lamb, £3.

[5] Sheep (entered in any of the above classes, male or female) carrying the fleece best adapted for protecting the animal in a high exposed and stormy climate, £2.

[6] Prizes for the Shepherds in charge of the Blackfaced Sheep gaining the largest amount of money in prizes. First Prize, £3; Second Prize, £2.

Duke of York's Medal for best pen of Blackfaced Sheep.

	1st.	2d.	3d.	
CHEVIOT.				
82. Tup above one shear . .	10	5	3	
83. Shearling Tup . . .	10	5	3	
84. Three Ewes above one shear, with their Lambs at foot . .	8	4	2	
85. Three Shearling Ewes or Gimmers .	8	4	2	
Duke of York's Medal for best pen of Cheviot Sheep.				64
			Carry forward	£146

[1] Given by Mr Howatson of Dornel. For this Prize animals may be drawn from Class 77, or entered specially in Class 78; but for each group of 5 Tups a separate Entry Form must be sent in at the time of entry, giving particulars of the Tups composing the group.

[2] Given by Mr Howatson.

[3] Given by Sir T. D. Gibson Carmichael, Bart.

[4] Given by Mr Howatson. Animals competing for this Prize must be entered separately in this class.

[5] Given by Mr Howatson. No separate entry required for this prize.

[6] Given by Mr Howatson.

Class		1st. £	2d. £	3d. £	
	Brought forward				£146
	BORDER LEICESTER.				
	Tweeddale Gold Medal for best Tup—£20.				
86.	Tup above one shear . . .	10	5	3	
87.	Shearling Tup . . .	10	5	3	
88.	Three Ewes above one shear . .	8	4	2	
89.	Three Shearling Ewes or Gimmers .	8	4	2	
	Duke of York's Medal for best pen of Border Leicesters.				64
	SHROPSHIRE.				
90.	Tup above one shear . . .	6	4	2	
91.	Shearling Tup . . .	6	4	2	
92.	Three Ewes above one shear . .	5	3	2	
93.	Three Shearling Ewes or Gimmers .	5	3	2	
	Duke of York's Medal for best pen of Shropshires.				44
	EXTRA SECTIONS.				
94.	Three Blackfaced Wethers, two shear	4	2	—	
95.	Three Blackfaced Wethers, one shear	4	2	—	
96.	Three Cheviot Wethers, two shear .	4	2	—	
97.	Three Cheviot Wethers, one shear .	4	2	—	
98.	[1] Three Cross-bred Wethers, one shear	4	2	—	
99.	Five Fat Lambs, any breed or cross .	4	2	—	
	[2] Best Pen of Blackfaced Wethers in Classes 94 or 95, age and quality considered—£2.				
	[3] Best Pens of Cross-bred Lambs in Class 99 got by a Shropshire Tup—First Prize, £5; Second, £3; Third, £2.				36
	Duke of York's Medal for best pen of Fat Sheep.				£290

SWINE

Class		1st. £	2d. £	
	LARGE WHITE BREED.			
100.	Boar	4	2	
101.	Sow	4	2	
102.	Three Pigs, not above 8 months old .	4	2	£18
	WHITE BREED OTHER THAN LARGE.			
103.	Boar	4	2	
104.	Sow	4	2	
105.	Three Pigs, not above 8 months old .	4	2	18
	BERKSHIRE.			
106.	Boar	4	2	
107.	Sow	4	2	
108.	Three Pigs, not above 8 months old .	4	2	
	Duke of York's Medal for best pen of Swine.			18
				£54

[1] Cross-bred Wethers must be the offspring of any Whitefaced or Short-Woolled Tup with Blackfaced Ewes, or the progeny of Blackfaced Tups with Whitefaced or Short-Woolled Ewes. [2] Given by Mr Howatson.
[3] Given by Scotch Breeders of Shropshire Sheep, per Mr Buttar.

JUMPING COMPETITIONS

SPECIAL REGULATIONS.

(*See also the Regulations on pages* 59 *to* 68.)

1. Jumping Competitions will take place on the afternoons of Wednesday, Thursday, and Friday, the 25th, 26th, and 27th July.
2. *Entries* for each day's Competitions will close at the Secretary's Office in the Show-yard at 6 P.M. on the preceding day.
3. *Entry Fees.*—For classes for Horses—Wednesday, £1; Thursday and Friday, 10s. for each class. Pony classes—Wednesday, 10s.; Thursday and Friday, 5s. for each class.
4. *Accommodation* for jumping horses will be provided as follows:—Covered shed in which to stand during the day free of charge; or, on application to the Secretary not less than seven days before the opening of the Show, stalls or loose-boxes will be provided at a charge (in addition to the Entry Fee) of £1 for a stall, and £1, 10s. for a loose-box, which must be paid along with the Entry Fee at the time of application.
5. Horses entered for jumping only need not enter the Show-yard till 10 A.M. on the day of Competition, and may leave the Show-yard at 6 P.M. each day.
6. *The Jumps* may consist of Single Hurdle, Gate, Double Hurdle, Wall, and Water Jump, power being reserved by the Society to alter these, as well as the Handicaps, as may be thought desirable.

Class	1st. £	2d. £	3d. £	
Wednesday.				
1. Horses—open	20	10	5	
2. Ponies, 14½ hands and under	5	3	1	
Thursday.				
3. Horses, Open Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in Class 1	10	6	3	
4. Ponies, 14½ hands or under, Handicap, hurdles and gate being raised 4 inches for first prize-winner in Class 2	5	3	1	
Friday.				
5. Horses, Open Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in either of Classes 1 or 3—4 inches extra for the winner of the two first prizes in Classes 1 and 3	10	6	3	
6. Ponies, 14½ hands or under, Handicap, hurdles and gate being raised 4 inches for the winner of the first prize in Class 2 or in Class 4, and 8 inches for winner of the first prize in both these Classes	3	2	1	
				£97

Champion Prize of £10, given by Sir Allan Mackenzie, Bart., and Mr Gordon of Newton, for the winner of most points in Prizes in the above Jumping Competitions,—First Prize to count three points, Second Prize two points, and Third Prize one point—the money to be divided in the event of equality.

EXTRA STOCK

Animals not included in the Classes for Competition may be exhibited as Extra Stock, and will receive Honorary Premiums when specially commended, as follows:—

CATTLE AND HORSES.

Very highly commended .	Medium Gold Medal.
Highly commended .	Minor Gold Medal.
Commended . .	The Silver Medal.

SHEEP AND SWINE.

Very highly commended .	Minor Gold Medal.
Highly commended .	The Silver Medal.
Commended . .	Medium Silver Medal.

POULTRY

First Premium — One Sovereign; *Second Premium* — Ten Shillings; one Commended Ticket—in all the Sections of Poultry.

Aged Birds must have been hatched previous to, and Cockerels and Pullets in, 1894.

	Class	Class
Dorking—*Silver Grey* .	1. Cock	2. Hen
	3. Cockerel	4. Pullet
Dorking—*Coloured* .	5. Cock	6. Hen
	7. Cockerel	8. Pullet
Cochin-China . .	9. Cock	10. Hen
	11. Cockerel	12. Pullet
Brahmapootra . .	13. Cock	14. Hen
	15. Cockerel	16. Pullet
Scotch Grey . .	17. Cock	18. Hen
	19. Cockerel	20. Pullet
Hamburg . .	21. Cock	22. Hen
	23. Cockerel	24. Pullet
Plymouth Rock .	25. Cock	26. Hen
	27. Cockerel	28. Pullet
Minorca . . .	29. Cock	30. Hen
	31. Cockerel	32. Pullet
Leghorn . . .	33. Cock	34. Hen
	35. Cockerel	36. Pullet
Langshan .	37. Cock	38. Hen
	39. Cockerel	40. Pullet
Wyandotte . .	41. Cock	42. Hen
	43. Cockerel	44. Pullet
Any other Pure Breed	45. Cock	46. Hen
	47. Cockerel	48. Pullet
Game—*Black or Brown Reds*	49. Cock	50. Hen
	51. Cockerel	52. Pullet

	Class	Class
GAME—*Any other Pure Breed*	53. Cock	54. Hen
	55. Cockerel	56. Pullet
BANTAMS—*Any Pure Breed*	57. Cock	58. Hen
	59. Cockerel	60. Pullet
DUCKS—*White Aylesbury*	61. Drake	62. Duck
	63. Drake (Young)	64. Duckling
DUCKS—*Rouen* . .	65. Drake	66. Duck
	67. Drake (Young)	68. Duckling
DUCKS—*Any other Pure Breed*	69. Drake	70. Duck
	71. Drake (Young)	72. Duckling
TURKEYS—*Any Pure Breed*	73. Cock	74. Hen
	75. Cock (Poult)	76. Hen (Poult)
GEESE—*Any Pure Breed* .	77. Gander	78. Goose
	79. Gander (Young)	80. Gosling

Amount of Poultry Premiums, £120.

DAIRY PRODUCE

Class		Premiums. 1st. £	2d. £	3d. £	
1.	Cured Butter, not less than 7 lb. .	4	2	1	
2.	Powdered Butter, not less than 7 lb. .	4	2	1	
3.	Fresh Butter, three 1-lb. rolls . .	4	2	1	
					£21

No Exhibitor to show more than one lot in any Class.

HORSE-SHOEING

(*Prizes given by Sir James H. Gibson-Craig, Bart.*)
Open to Shoeing Smiths from any part of Scotland.

Class I. DRAUGHT-HORSES.—*Thursday*, at 10 A.M.
Prizes: 1st, £3; 2d, £2; 3d, £1.

Class II. ROADSTERS.—*Friday*, at 10 A.M.
Prizes: 1st, £3; 2d, £2; 3d, £1.

1. Entries must be made with the SECRETARY not later than 18th June. Entry Fee, 5s. for each Competition. Entry Forms may be had on application.

2. Each Competitor will be required to make, take off, and put on one or two shoes, as may be directed by the Judge.

[The following sizes of S.C. Crown Iron will be supplied:—$\frac{3}{4}$ by $\frac{1}{2}$, 1 by $\frac{1}{2}$, $1\frac{1}{4}$ by $\frac{1}{2}$, and $1\frac{1}{2}$ by $\frac{5}{8}$. The holes in the anvils will be $1\frac{1}{4}$ square, and $\frac{5}{8}$ round.]

3. In awarding the prizes, the time taken in the forging and fitting of the Shoe will be considered by the Judge.

4. The competitor must bring his own tools and nails, and provide his own striker, if he requires one; but the Society will provide forge, anvil, iron, and fuel.

5. Any Competitor who does not attend at the Horse-Shoeing Shed and answer to his name at 10 A.M. on the day on which he is entered for competition will be debarred from competing.

6. The Competitor and his striker will be admitted to the Yard free of charge on the day of Competition on presentation of tickets which will be sent to the Competitor for the purpose.

WORKING DAIRY

A Working Dairy will be in operation during the Show.

BUTTER-MAKING COMPETITIONS

(Open to Men and Women.)

Wednesday.—First Prize, £3; Second do., £2; Third do., £1.
Thursday.—First Prize, £3; Second do., £2; Third do., £1.
Friday.—Champion Competition, open only to winners of Prizes on the preceding days. First Prize, the Society's Silver Medal; Second do., the Society's Bronze Medal.

Entries must be made with the SECRETARY not later than 18th June. Entry Fee, 2s. 6d. for each Competition.

IMPLEMENTS

No Trials of Implements will be held by the Society at this Show.

The Petroleum Engines, exhibited in the Showyard, will be inspected and reported on.

EXHIBITION OF BINDERS

An exhibition of Binders at work will be held in the district of the Show during Harvest of 1894. Entries close July 7. Particulars will be had on application to the Secretary.

TRIAL OF MANURE DISTRIBUTORS

A trial of Machines for Distributing Artificial Manures will be held in the district of the Show, at a time and place to be afterwards fixed. First Prize, £10; Second Prize, £5. Entries close July 7.

HIGHLAND INDUSTRIES AND FISHERIES

The Section for Highland Industries and Fisheries in the Showyard will be under the Management of the Scottish Home Industries Association, and in connection with the sale of that Association, which will be held in Aberdeen at the time of the Show.

Entries must be made not later than Monday, 18th June, with the Secretary of the Scottish Home Industries Association, Miss Paterson, 15 Regent Quay, Aberdeen, who, on application, will furnish entry forms and information as to forwarding goods, &c. No Entry Fee charged.

Exhibits must be delivered in the Showyard not later than the forenoon of Monday,

23d July, carriage paid, and addressed "Scottish Home Industries Association," Showyard, Aberdeen.

Sale of Goods.—The Scottish Home Industries Association undertakes the sale of the exhibits, retaining 6d. per £1 towards expenses, and returns unsold goods, the exhibitor paying carriage.

NOTE.—*Exhibitors and those acting for them are* EARNESTLY *requested to attend carefully to the instructions given, so that errors and unnecessary labour may be avoided.*

LIST OF PREMIUMS

Offered by the Highland and Agricultural Society.

Open to Competitors from all parts who comply strictly with the conditions.

KNITTING.

Section A, of S. Home Industries Association.

Class.		Premiums. 1st. s.	2d. s.
1.	Fine white Shetland Shawl (sub-section 2, S.H.I.A.)	40	15
2.	Thick coloured Shetland Shawl (sub-section 3, S.H.I.A.)	40	15
3.	Collection of not less than five articles of native wool, hand-spun, home-dyed, and knitted by Exhibitor (sub-sections 1, 4, 5, 6, 7, 8, 9, 10, and 11, S.H.I.A.)	40	20

STOCKINGS.

Section B, of S. Home Industries Association.

4.	Six pair Stocking-hose, hand-spun, home-dyed, and knitted by Exhibitor—two pair plain ribbed, two pair fancy, and two pair diced-tartan (sub-sections 1, 2, 4, and 5, S.H.I.A.)	40	20
5.	Six pair Socks of blackfaced wool, hand-spun, home-dyed, and knitted by Exhibitor (sub-section 3, S.H.I.A.)	20	10
6.	Six pair Socks Cheviot wool, hand-spun, home-dyed, and knitted by Exhibitor (sub-section 3, S.H.I.A.)	20	10

SPINNING AND WEAVING.

Section D, of S. Home Industries Association.

7.	Pair of Blankets, home-spun, hand-loom woven (sub-section 1, S.H.I.A.)	20	10
8.	Web, not less than 25 yards, Tweed, Cheviot wool, hand-spun, home-dyed, and hand-loom woven (sub-section 3 or 7, S.H.I.A.)	40	20
9.	Web, not less than 25 yards, Tweed, blackfaced wool, hand-spun, home-dyed, and hand-loom woven (sub-section 3 or 7, S.H.I.A.)	40	20
10.	Web, not less than 25 yds., light texture for ladies' dresses, native wool, home-spun, home-dyed, and hand-loom woven (sub-section 3, S.H.I.A.)	40	20
11.	Web, not less than 8 yards, of Shetland Tweed, of Shetland wool, hand-spun, and hand-loom woven	20	15
12.	Piece of Wincey, hand-loom woven (sub-section 5, S.H.I.A.)	40	20
13.	Two Plaids, native wool, hand-spun, home-dyed, and hand-loom woven (sub-section 9, S.H.I.A.)	40	20
14.	Varieties of Yarn, not less than 4 cuts, hand-spun, home-dyed, suitable for stockings (sub-section 12, S.H.I.A.)	20	10
15.	Four cuts Yarn, undyed (for quality), hand-spun, suitable for blankets (sub-section 11, S.H.I.A.)	20	10
16.	Linens (sub-section 14, S.H.I.A.)	40	20

FISHING AND GARDENING.

Section I, of S. Home Industries Association.

17.	Box for carriage of fish to market	20	10
18.	Collection of Trout and Salmon Flies, home-made	30	10
19.	Fishing-rods and Reels (sub-section 11, S.H.I.A.)	20	10
20.	Nets, fishing, or any other kind (sub-section 10, S.H.I.A.)	20	10
21.	Baskets for garden, farm, or fishing purposes (sub-section 9, S.H.I.A.)	20	15

The Scottish Home Industries Association intimate that no prizes other than the above will be offered this year in sections A, B, and D of its Schedule.

ABSTRACT OF PREMIUMS.

[20 Champion Medals by H.R.H. The Duke of York, K.G.]

Given by the Society.

1.	Cattle	£762	0	0
2.	Horses	534	0	0
3.	Jumping	97	0	0
4.	Sheep	290	0	0
5.	Swine	54	0	0
6.	Poultry	120	0	0
7.	Dairy Produce	21	0	0
8.	Butter-making Competitions	12	0	0
9.	Highland Industries and Fisheries	50	0	0
10.	Medals to Breeders, &c.	6	0	0
11.	Extra Stock, say	100	0	0
		£2046	0	0
	Less—Amount contributed by the Scotch Committee of the Hackney Horse Society, as below	44	0	0
		£2002	0	0

Given by

1.	The Shorthorn Society	£20	0	0			
2.	Mr C. Macpherson Grant of Drumduan,—Cups and Prizes	124	0	0			
3.	The Polled Cattle Society,—Two Gold Medals	17	0	0			
4.	Mrs Morrison Duncan of Naughton,	10	0	0			
5.	Mr Lockhart, Mains of Airies	10	0	0			
6.	Cawdor Cup	52	10	0			
7.	Mr Gilmour of Montrave	25	0	0			
8.	The Scotch Committee of the Hackney Horse Society	44	0	0			
9.	Hackney Horse Society	10	0	0			
10.	Mr Howatson of Dornel	62	0	0			
11.	Sir T. D. Gibson Carmichael, Bart.	10	0	0			
12.	Scotch Breeders of Shropshires, per Mr D. Buttar	10	0	0			
13.	Tweeddale Gold Medal	20	0	0			
14.	Sir James H. Gibson-Craig, Bart.	12	0	0			
15.	Sir Allan Mackenzie and Mr Gordon of Newton	10	0	0			
					436	10	0
					£2438	10	0

JAMES MACDONALD, *Secretary.*

3 George IV. Bridge,
Edinburgh, *February* 1894.

The General Show of Stock and Implements will be held at Dumfries in 1895.

MEMBERS ADMITTED SINCE THE LIST WAS PUBLISHED IN APRIL 1893.

ARRANGED ACCORDING TO SHOW DISTRICTS.

ELECTED 14TH JUNE 1893 AND 17TH JANUARY 1894.

1.—GLASGOW DISTRICT.

ARGYLL.

Admitted
1893 Buik, Herbert, Keil House, Ballachulish
1894 Campbell, John, Ardifuir, Kilmartin, Lochgilphead
1893 Clark, Francis Wm., of Alva, Aros, N.B.
1894 Colville, Robert, Glensaddell, Campbeltown
1893 Ferguson, Archd., Lochaline, Morven
1894 Greig, James, Chiskan, Campbeltown
1894 Inglis, George Erskine, Machrahanish Estate Office, Campbeltown
1893 Macdonald, J. Ronald M., Largie Castle, Tayinloan
1893 M'Dougall, Duncan C., Ashens, Tarbert, Lochfyne
1893 M'Intyre, John Alexander, Ichrachan, Taynuilt, Oban
1894 M'Nair, Archibald, Moy, Campbeltown
1893 Mundell, James, Achnacarnan, Tarbert, Lochfyne
1893 Scarlett, W. J. Yorke, Gigha
1894 Stewart, Archibald, Darlochan, Campbeltown
1893 Thom, Allan Gilmour, Canna
1893 Veitch, John, jun., Cretsheugan, Tarbert

AYR.

1893 Bone, David, Auchencloich, Sorn, Galston
1893 Borland, John Kennedy, North Balloch, Girvan—*Free Life Member*
1894 Campbell, James Archd., of Craigie, Ayr
1894 Gray, William, Grougar Bank, Galston
1894 Hunter, Hugh, Mossbog, Tarbolton
1893 Morton, Alexander, Gowanbank, Darvel
1894 Robertson, Andrew, Holmes Farm, Kilmarnock
1893 Shaw, Philip A., Wellington House, Ayr
1893 Wilson, Robert, Auchincloigh, Ochiltree

LANARK.

1893 Boyle, Adam H., Rushhill House, Maryhill
1894 Glen, Wm., 32 Berkeley Terrace, Glasgow
1893 Gordon, Henry Erskine, Aikenhead House, Cathcart
1893 Hamilton, Robert, High Motherwell, Motherwell
1894 Howie, Matthew G., Law Farm, Dreghorn
1893 Kennedy, M. H., Contractor, Partick, Glasgow
1893 Leiper, Robert, Yardbent, Strathaven
1893 Mitchell, James, Hazleside, Douglas
1893 Moore, Wardrop, yr. of Greenhall, Blantyre
1893 Murdoch, James C., West Hallside, Newton, Glasgow
1893 Murdoch, Wm., 3 Eglinton Lane, Glasgow
1893 Neilson, James, of Mossend, Carfin Hall, Holytown
1893 Reid, C., Photographer, Wishaw
1894 Russell, Alexander, 175 West George Street, Glasgow
1893 Wallace, Jas., Graham Square, Glasgow
1893 Wallace, Robt., Graham Square, Glasgow
1894 White, David, 182 Hope Street, Glasgow

RENFREW.

1893 Campbell, J. M., Writer, Auldfield Place, Pollokshaws
1893 Coats, Andrew, Ferguslie, Paisley
1894 Houston, William F., V.S., Paisley
1894 Hunter, Andrew, Braehead House, Cathcart
1894 Mather, William, Netherplace, Mearns
1893 Richmond, Andrew, M.B., C.M., 57 Love Street, Paisley
1894 Scott, William, Denniston, Kilmalcolm
1894 Thomson, Malcolm B., Park House, Renfrew

2.—PERTH DISTRICT.

FIFE.

1894 Auchmuty, George, Bowhouse of Wemyss, West Wemyss
1893 Balfour, Thomas C., Carberry, Leven
1893 Balfour, William, jun., Ovenstone, Pittenweem
1893 Bayne, James, Muirhead, Freuchie
1893 Bell, George, Downfield, Ladybank
1893 Berwick, Andrew, Hayston, Leuchars
1893 Blyth, Robert, Balmbreich, Newburgh
1893 Bonthron, John, Pitkerrie, Anstruther
1893 Borrowman, James, V.S., Cupar-Fife
1893 Brewster, John, Newhall, Crail

1894 Butters, Hugh, Masterton, Dunfermline
1893 Cook, David, Luthrie, Cupar-Fife
1894 Duncan, David J. Russell, Kilmux, Leven
1893 Duncan, Robert, Craigfoodie, Cupar-Fife
1893 Erskine, Colonel W., yr. of Cambo, Crail
1893 Finlayson, James, Beley, Stravithie
1893 Fleming, Andrew, Hallteases, Ceres
1893 Gibb, James, Easthall, Cupar-Fife
1893 Horn, David, Drumcarro, St Andrews
1893 Husband, Thos. R., Gellet, Dunfermline
1893 Kelloch, George, Balmerino, Newport
1893 Kydd, John, Rhynd, Leuchars
1893 Lauder, Thos., St Nicholas, St Andrews
1893 Meiklem, James Begg, Kirkcaldy
1893 Meiklem, William Begg, Kirkcaldy
1893 Melville, Thomas Robertson, Kettle
1893 Milne, John, Annfield, Cardenden
1894 Mitchell, Alexander, of Luscar, Dunfermline
1893 Morgan, John, Nocknary, Auchtermuchty
1893 Muir, Alex., of Ballinkirk, Markinch
1893 Porter, James, Prinlaws House, Leslie
1893 Reid, Robert, The Grove, Strathmiglo
1893 Rintoul, Wm., Mains of Blebo, Cupar
1893 Roger, William, Kingsbarns
1893 Scott, Douglas, Newton of Wemyss, Fifeshire
1893 Scott, John, Newton of Wemyss, Fifeshire
1894 Shepherd, William, Solicitor, Leven
1893 Stirling, John, Auchmuthy, Markinch
1893 Taylor, William, Bankhead, Thornton
1893 Turnbull, Mark, Randerston, Crail
1893 Watson, Arthur, Kinnear, Leuchars
1893 Watt, Frank M. Caldwell, Collessie

FORFAR.

1893 Bell, Pat Arnot, Auchtertyre, Newtyle
1894 Bell, William, Balnuith, Dundee
1893 Donaldson, Jas., Legerlaw, Coupar-Angus
1893 Ferguson, James A., Architect, Glamis
1893 Fergusson, R. A., of Ethiebeaton, Dudhope Works, Dundee
1893 Murray, John Kennedy, Crosstown, Forfar
1893 Thomson, David Couper, 'Courier' Office, Dundee
1893 Whyte, Wm., jun., Spott, Kirriemuir

KINROSS.

1893 Barclay, John, Pittendreich, Kinross

PERTH.

(Eastern Division.)

1893 Adamson, James, Grange, Errol
1893 Allan, James, Implement Maker, Tibbermuir
1893 Baxter, Wm., jun., Tophead, Stanley
1893 Boyd, James Laurence, of Glendouglie, Glenfarg
1894 Caird, Dr J. Hay, Ballinloan, Rannoch
1893 Fotheringham, Robert, Southfield, Blair-Drummond
1894 Gray, Thomas, Fingask, Rhynd, Perth
1893 Howieson, James, Rannagullzion, Blairgowrie
1894 Howison, Robert, East Inchmichael, Errol
1893 Jackson, Thos. D., Live Stock Salesman, Perth
1893 Keay, Peter, Marybank, Herriotfield, Logie Almond
1894 Kidd, George, Drumkilbo, Meigle
1894 Kirk, J. M., 22 St John Street, Perth
1894 Leslie, Thomas, Kinloch Arms Hotel, Meigle
1893 Menzies, Robert, Millhaugh, Herriotfield, Logie Almond
1893 Miller, William, jun., Kilspindie, Errol
1893 Paton, Wm. B., Monorgan, Longforgan
1893 Pattullo, T. M., Ashmore Farm, Blairgowrie
1894 Rhind, John, Wester Kinloch, Blairgowrie
1893 Stewart, Alex. Blair, Balnakeilly, Pitlochry
1893 Sutherland, William, Peel, Tibbermuir

3.—STIRLING DISTRICT.

CLACKMANNAN.

1893 Donaldson, Robert, Tullibody, Alloa
1893 Gall, William, King Street, Alloa
1893 Jeffrey, Robert, Meadowend Farm, Clackmannan
1893 M'Leod, Geo., Land-Steward, Harvieston Castle, Dollar
1893 M'Nab, Alexander, Middleton Kerse, Menstrie
1893 Millar, John M., Sheardale Haugh, Dollar
1893 Norval, Alex., Solicitor, 38 High Street, Alloa
1893 Peebles, James, Land-Steward, Naemoor, Rumbling Bridge
1893 Robertson, R. G., M.R.C.V.S., Alloa

DUMBARTON.

1894 Brock, Hugh B. P., Auchenheglish, Alexandria, N.B.
1893 Galloway, Thomas, of Glenlorum House, Bearsden
1893 Leith, Alex. Wellesley, yr. of Ross, Dumbartonshire (Northern Club, Glasgow)
1893 M'Dougall, John, Inverouglas, Dumbartonshire

PERTH.

(Western Division.)

1894 Dougal, James, Blaircessnock, Port of Monteith
1894 Dunn, Jas., Inverardoch Mains, Doune
1894 Graham, Donald, of Airthrey Castle, Bridge of Allan
1893 M'Dougall, John, Benglass Farm, Crianlarich
1894 M'Ewen, John, Land-Steward, Thornhill, Methil
1893 Mackay, John, Brucehill of Cardross, Port of Monteith
1894 White, Harry, Stronvar, Lochearnhead

STIRLING.

1894 Kinross, Henry (James Gray & Co., Seedsmen), Stirling
1894 M'Farlan, Parlan, Shore Wharf, Stirling
1893 Mackison, John, Hillhead Farm, Thornhill, Stirling

4.—EDINBURGH DISTRICT.

EDINBURGH.

1894 Babington, William, 81A George Street, Edinburgh
1894 Baird, Archibald, M.R.C.V.S., 40 York Place
1894 Bryden, Robert, 55 George Street
1894 Buchanan, Robert, Livingston Mill, Livingston, Mid-Calder
1893 Cox, Chas. T., W.S., 9 Buckingham Ter.
1894 Crichton, David, 47 George Street
1894 Crichton, Wm., Parduvine, Gorebridge
1894 Cunningham, Lawrence, Thornbank, Juniper Green
1893 Cuthbert, Thomas Wilkinson, Dalmeny Park
1893 Dick, Thomas, Farmer, Wester Causewayend, Kirknewton
1894 Douglas, James Henry, Whitehill, Rosewell
1893 Fleming, John, Coates, Penicuik
1893 Ford, Jas., Saughton Hall Mains, Gorgie
1893 Gardner, William G., Carrington Barns, Gorebridge
1893 Gibson, George, Brunstane Mills, Musselburgh
1893 Graham, David, Leyden, Kirknewton
1893 Hay, Robert, Councillor, Huntly Street, Canonmills
1894 Johnston, Henry, Advocate, 33 Moray Pl.
1894 Kennaway, David, Polton Farm, Lasswade
1894 Kidd, William, Pinkie, Musselburgh
1893 Macfie, J. W., of Dreghorn, Colinton
1893 Macmillan, John, Corstorphine Hill House
1894 Melville, Viscount, Melville Castle, Lasswade
1893 Nisbet, Robert, Kingsknowes, Slateford
1893 Pitman, A. R. C., W.S., 48 Castle Street
1894 Poole, Wm., Corn Exchange Buildings
1893 Ross, Alexander, Edinburgh Live Stock Mart, Edinburgh
1893 Smith-Sligo, Archibald D. (of Inzievar and Carmyle), 5 Drummond Place
1893 Somner, George (Peter Lawson & Son, Limited), 1 George IV. Bridge
1893 Stark, James, 26 Earl Grey Street
1893 Stavert, David Riddell, 7 St Andrew Square
1894 Stewart, William, Dalhousie Castle, Bonnyrigg
1893 Stockman, Stewart, M.R.C.V.S., 8 Clyde Street
1893 Taylor, J. Pringle, Dunsmure, Corstorphine
1893 Taylor, Jas. (Easter Drylaw), Bangholm House, Ferry Road, Edinburgh
1893 Taylor, S. P. (Peter Lawson & Son, Limited), 1 George IV. Bridge
1893 Tennent, David B. Clark, Cammo, Cramond Bridge
1893 Thomson, Robert Harvey, 26 Royal Terrace
1893 Thyne, Kennard, Pentland Mains, Loanhead
1893 Torphichen, Lord, Calder House, Mid-Calder
1894 Torrance, T. A., Kippielaw, Dalkeith
1893 Tytler, James Wm. Fraser-, Woodhouselee, Mid-Lothian
1893 Usher, Frederick, Norton Mains, Ratho
1893 Whitson, George, 147 Gilmore Place
1893 Young, James (James Young & Sons) Bryson Road
1894 Younger, William, 29 Moray Place

HADDINGTON.

1893 Amos, John, Alderston, Haddington
1893 Bannatyne, William, V.S., Haddington
1893 Bertram, Andrew, Townhead, Gifford
1893 Binnie, Robert J., Seton Mains, Longniddry
1893 Clark, John, Wamphray, North Berwick
1893 Cree, W., of Gifford Bank, Gifford
1893 Gordon, A. A., Coalstoun Estate Office, Haddington
1893 Gregor, Charles E., Innerwick, East Lothian
1893 Hepburn, Archibald Buchan, Smeaton-Hepburn, Prestonkirk
1893 Horn, Wm., of Woodcote Park, Blackshiels
1893 Hume, A., V.S., Haddington
1893 Hunter, William, Woodside, Gladsmuir
1893 Knox, Robert, Carlaverock, Tranent
1893 Lee, Joseph, Markle, Prestonkirk
1893 Park, John, Haprig, Macmerry
1894 Reid, James, Twynholm, Pencaitland
1893 Ritchie, J. B. Samuelson, Haddington
1894 Robertson, John, Beanston Mains, Haddington
1893 Stewart, John, Nisbet, Pencaitland
1893 Wylie, Robert, Haugh, North Berwick

LINLITHGOW.

1893 Paul, James, Walton, Linlithgow
1894 Robertson, John, Ochiltree Place, Linlithgow

5.—ABERDEEN DISTRICT.

ABERDEEN.

1893 Anderson, William, Bon Accord Works, Aberdeen
1894 Anderson, Wm., Saphock, Old Meldrum
1893 Ballingall, Robert Rennie, Crimmonmogate, Lonmay
1893 Baron, James, C.E., 7 Union Terrace, Aberdeen
1894 Brown, Robert, Mains of Williamson, Culsalmond
1893 Clarke, John Charles, Meddat, Parkhill, Aberdeen
1893 Cocker, George, Hill of Petty, Fyvie
1894 Cormack, James W., Kinmundy, Summerhill, Aberdeen
1893 Cox, Edmund C., Granahome House, Aberdeen
1894 Cruickshank, John, Mains of Balmaud, Turriff
1894 Cruickshank, Robert, Caynires, Turriff
1893 Davidson, James, The Mains, Haddo House, Aberdeen
1894 Durno, James, Westertoun, Warthill
1893 Ferguson, James, jun. of Kinmundy, Mintlaw (10 Wemyss Place, Edin.)

1893 Forbes, J. C. Ogilvie, of Boyndlie, Fraserburgh
1894 Gall, Wm., Smiddyburn, Rothie Norman
1893 Gibson, Thomas Hayton, Cultercullen, Foveran
1894 Gordon, Charles T., of Cairness, Lonmay
1894 Grant, William, Faichill, Gartly
1894 Gray, William, Keilyford, Old Meldrum
1894 Gray, William, Balgove, Old Meldrum
1894 Henderson, James, Orchard Cottage, Old Aberdeen
1893 Hendry, Peter, Hillockhead, Huntly
1893 Irvine, Francis Hugh Forbes, of Drum, Drumoak
1894 Keith, Alexander, Kinnermit, Turriff
1894 Lumley, Theodore, Commissioner, Strichen Estate, Strichen
1894 Mark, William, 69 George Street, Huntly
1894 Mearns, Bailie Danl., Quayside, Aberdeen
1893 Merson, John, Millhill, Gartly
1893 Profeit, Alex., jun., Dorsincilly, Glenmuick, Ballater
1894 Ramsay, Capt. Burnett, Rifle Brigade, Banchory Lodge, Banchory
1894 Ramsay, William, jun., Dyce
1893 Ross, Robt. Robertson, 389 Holburn St., Aberdeen
1894 Rothnie, Geo., Cauldhame, Old Meldrum
1894 Russell, Col. F. S., C.M.G., of Aden, Mintlaw
1894 Ruxton, Chas., Ythan Lodge, Newburgh, Aberdeen
1894 Scott, William, Corsiestone, Huntly
1894 Sharpe, James Smith, Berryhillock, Premnay
1894 Sleigh, Charles William, M.A., Haddo House, Aberdeen
1894 Smith, Duncan M., 27 Argyll Place, Aberdeen
1894 Smith, Robert, jun., Boggieshalloch, Turriff
1893 Stoddart, George, Annfield, Huntly
1894 Strachan, Wm., Upper Muirden, Turriff
1894 Taylor, J. W., Middle Ardo, Belhelvie
1893 Walker, Roderick, Meiklefolla, Rothienorman

BANFF.

1893 Seafield, Countess-Dowager of, Cullen House, Cullen
1893 Addison, Alexander, Cattle Dealer, Moss Street, Keith
1893 Allan, George M., of Montbletton, Banff
1893 Anderson, Geo., Drummuir Home Farm, Keith
1893 Anderson, James, Minmore, Glenlivet
1893 Andrew, William, Rannes, Buckie
1893 Barclay, Geo., Strocherie, King Edward, Banff
1893 Beaton, L., The Farm, Cullen House, Cullen
1893 Bisset, James, of Paddocklaw, Kilnshade, Macduff
1893 Bowie, James, Flesher, Keith
1893 Dey, James, Forkins, Botriphnie, Keith
1893 Donald, Geo., of Ladyhill, Grange, Keith
1893 Fortune, John, Broom, Portsoy
1893 Guthrie, William, Brunton, Cullen
1893 Johnston, A. G., Distiller, Glenisla, Keith
1894 Livingstone, William, Newton of Mountblairy, Banff
1893 Marsden, Wm. James, V.S., Castle St., Banff
1893 Moggach, Joseph, Mains of Towiebeg, Botriphnie, Keith
1893 Ross, William, Hilton, Buckie
1893 Simpson, Jas., Inverboyndie Distillery, Banff
1894 Taylor, William L., Union Bank, Cullen
1894 Thomson, Wm., Tynet Mills, Port-Gordon
1893 Wilson, James, of Myrieward, Tenrood, Botriphnie, Keith

FORFAR.

(Eastern Division.)

1893 Adamson, William S., Careston Castle, Brechin
1893 Allison, Archibald, Dubton, Brechin
1894 Campbell, Dr Archibald, Keenie, Edzell
1893 Coupar, Andrew, jun., West Kintrockat, Brechin
1893 Hall, George, Caithness Cottage, Carnoustie
1894 Jarron, James Alexander, Arbikie, Inverkeillor, Arbroath
1894 Milne, Andrew C., Grange, Inverkeillor, Arbroath
1894 Rodger, John Laurie, Nether Careston, Brechin
1894 Swan, Wm. C., Inverpeffer, Carnoustie

KINCARDINE.

1894 Baird, Henry Robt., of Durris, Aberdeen
1893 Brown, Geo. T., East Cairnbeg, Fordoun
1893 Crichton, William, Castleton of Kincardine, Laurencekirk
1893 Martin, James, sen., Farrochie, Stonehaven
1894 Milne, James, jun., Easte Cairnbill, Fetteresso, Muchalls
1894 Myles, John Blythe, Pitcarry, Bervie
1894 Shaw, Charles, Maidenfold, Maryculter
1893 Stewart, George, Haulkerton Mains, Laurencekirk
1893 Taylor, John, Uras, Stonehaven

6.—DUMFRIES DISTRICT.

DUMFRIES.

1893 Allison, Colonel William Henry, Park End, Lockerbie
1893 Allison, Herbert, Park End, Lockerbie
1893 Beattie, Lewis, Mossknowe, Canonbie
1893 Brand, David, Hangingshaw, Lockerbie
1893 Carruthers, Frank James Chambers, of Dixons, Lockerbie
1893 Duncan, John Bryce, Newlands, Dumfries
1893 Elliot, William, Westwater, Langholm
1893 Gilmour, Alex., Gairloch, Torthorwald, Dumfries
1893 Graham, Christopher, Skipmyre, Lochmaben
1893 Harper, Robert, Bankhead of Dalswinton, Dumfries
1893 Keswick, J. J. J., Dormont, Lockerbie
1893 Kirkpatrick, James, Amisfield, Townfoot, Tinwald, Dumfries
1893 Little, James, jun., Sark Tower, Canonbie
1893 M'Crone, Wm., Castlemilktown, Lockerbie
1893 Macdonald, Major William Bell, of Rammerscales, Lockerbie

1893 Moffat, James, Gateside, Sanquhar
1893 Park, Robert, Factor, Dryfesdalegate, Lockerbie
1893 Pender, James, Farmer, Morton Mains, Thornhill
1893 Richardson, John, Trailflat, Lochmaben
1893 Robson, John, County Buildings, Dumfries
1894 Vivers, William, Dornocktown, Annan

KIRKCUDBRIGHT.

1893 Milligan, J. M., Waterside, New Galloway
1893 Morton, David, Cally, Gatehouse
1894 Russell, Wm., Barend, Castle-Douglas

WIGTOWN.

1893 Adair, John, Springbank, Stranraer
1893 Agnew, Patrick Alex. Vans, yr. of Sheuchan and Barnbarroch, Whauphill
1893 Aitken, Alex., Solicitor, Church Street, Stranraer
1893 Anderson, John, Anabaglish, Kirkcowan
1893 Anderson, John, Drummoral, Isle of Whithorn
1894 Armitage, Arthur Calrow, of Kirroughtree, Newton-Stewart
1893 Baird, William, Kirvennie, Wigtown
1893 Bennoch, James, Sheuchan, Castlekennedy
1893 Bennoch, John, Solicitor, Stranraer
1893 Brown, John, Bridgehouse, Sorbie
1893 Candlish, Andrew, Claunch, Sorbie
1893 Christison, James, Barglass, Kirkinner
1893 Clanachan, Robert, Little Genoch, Dunragit
1893 Cochran, George, North Cairn, Kirkcolm
1893 Cochran, Robert, Portencallie, Kirkcolm
1893 Cochrane, James, Barscarrow, Sandhead
1893 Craig, Robert Joseph, Innerwell, Garlieston
1893 Drew, James Lawson, Dranandow, Newton-Stewart
1893 Fergusson, James, Back-of-Wall, Glenluce
1893 Findlay, Francis, Farmer, Appleby, Glasserton
1893 Findlay, Francis, Cutcloy, Isle of Whithorn
1893 Findlay, John Wood, Bailiewhir, Whithorn
1893 Gibson, William, Broch, Stranraer
1893 Hannay, John, Ponton, Garlieston
1893 Haswell, Robert, Challochmurr, Glenluce
1893 Kerr, George, Solicitor, Newton Stewart
1893 Kerr, Hugh, West Galdenoch, Stoneykirk
1893 Kerr, Matthew, Craiglemine, Glasserton
1893 Kerr, Thomas, Banker, Newton-Stewart
1893 M'Caig, R. Stewart, Kilhilt, Stranraer
1893 M'Conchie, Samuel, Risk, Newton-Stewart
1893 M'Connel, James, Boreland, Whauphill
1893 M'Creath, Thomas, Skaith, Newton-Stewart
1893 M'Dowall, William Hutcheson, Seedsman, &c., Kirkcowan
1893 M'Geoch, Thomas, Barncaughlaw, Newton-Stewart
1893 M'Gibbon, Wm., Ivy House, Stranraer
1893 M'Gill, Andrew, Barsalloch, Newton-Stewart
1893 M'Gill, Andrew, Kildonan, Stoneykirk
1893 Macgregor, William, V.S., Stranraer
1893 M'Keand, Alex. Forsyth, Carseriggan, Kirkcowan
1893 M'Lean, Charles Arbuthnot, Solicitor, Wigtown
1893 M'Naught, Alex., Hawthorn, Changue, Port-William
1893 Mathieson, William, Mindork, Kirkcowan
1893 Milroy, James, Craig, Whithorn, N.B.
1893 Murray, William, Farmer, Borrowmoss, Wigtown
1893 Nicholson, Andrew, Kidsdale, Whithorn
1893 Niven, John F., Mahaar, Kirkcolm
1893 Parlane, John, Craigdhu, Glasserton
1893 Pettigrew, James, Larg, Newton-Stewart
1893 Porteous, Andrew, Kirkland, Leswalt
1893 Robertson, James, Clendrie, Kirkcolm
1893 Salomon, William Thomas, Cornwall Park, Newton-Stewart
1893 Shaw, David Burnie, Garlieston
1893 Sprott, James, Dhuloch, Leswalt
1893 Stevenson, Robert, Glenside, Kirkcolm, Stranraer
1893 Symington, Thomas, Solicitor, Glenluce
1893 Taylor, Peter, Inchpark, Stranraer
1893 Templeton, Thomas, Auchinleck, Newton-Stewart
1893 Thorburn, John, Port-of-Spittle, Stoneykirk
1893 Tully, William, Colfin, Stranraer
1893 Young, William, Culnoag, Sorbie

7.—INVERNESS DISTRICT.

CAITHNESS.

1893 Geddes, Alex., Implement Maker, Wick

ELGIN OR MORAY.

1893 Adam, William, Chemical Works, Burghead
1893 Brander, James, Pittendreich, Elgin
1893 Brown, James, Miltonhill, Alves, Forres
1893 Bruce, Charles L., Auctioneer, Elgin
1893 Fettes, John, Westertown, Fochabers
1893 Fettes, William, Corskie, Garmouth
1893 Forbes, Robert, Woodhead, Forres
1893 Fraser, William, Waterford Mills, Forres
1893 Fraser, William, Waterfolds, Elgin
1893 Grant, Charles, Salterhill, Elgin
1893 King, William, Kingsmills, Elgin
1893 Knight, John, Kintrae, Duffus, Elgin
1893 Law, Arthur Woodland, Sanquhar Farm, Forres
1893 Leitch, Andrew, East Grange, Forres
1893 M'Culloch, Alex., Ardivot, Lossiemouth
1893 Mackessack, Charles, Wester Alves, Forres
1893 Mackessack, Charles, Asleask, Forres
1893 Maclean, George A., Hythehill, Elgin
1893 Matheson, William, Muirton House, Kinloss, Forres
1893 Mathieson, Alex., Doonpark, Forres
1893 Mavor, George, Cluny, Forres

1893 Mavor, John, Leckiehill, Forres
1894 Petrie, David, Gilston, Elgin
1893 Robertson, Hugh, Balnageith, Forres
1893 Scott, Hugh, Dallas, Forres
1893 Shiach, Gordon Reid, Surgeon Dentist, Elgin
1893 Simpson, William, Cowfords, Fochabers
1893 Stephen, Alex., Coxton, Lhanbryde, Elgin
1893 Stuart, James, Garbity, Orton, Elgin
1893 Tait, James, V.S., Forres

INVERNESS.

1893 Davidson, John, Rosehaugh Mains, Inverness
1894 Fraser, Alexander, Balloch, Culloden, Inverness
1894 Grant, John Peter, of Rothiemurchus (Inverichnie, Banff)
1893 Grant, William Robertson, (Buenos Ayres), Tullochgribbon, Grantown, Strathspey
1893 Macfarlane, And., Viewfield, Kingussie
1893 M'Kenzie, Alex., C.E., Kingussie
1893 Oberbeck, C., Central Restaurant, Inverness
1893 Watson, George, Muirtown, Inverness

NAIRN.

1894 Gowans, Charles F., Newton of Budgate, Cawdor, Nairn
1893 Johnston, W. T. (Arral & Co.), Nairn
1894 Russell, James, Blackhills, Nairn

ORKNEY.

1894 Davidson, Wm. Henry Bain, Kirkwall

ROSS AND CROMARTY.

1893 Binning, James, Keppoch, Dingwall
1893 Binning, John, Banker, Dingwall
1893 Brown, John, M.R.C.V.S., Invergordon, Ross-shire
1893 Forbes, Lachlan, Culcraigie, Alness
1893 Fraser, Donald, Balintore, Fearn
1893 Fraser, Donald, Balintore Hotel, Fearn
1893 Fraser, Malcolm F., Balaldie, Fearn
1893 Grant, William, Rarrichie, Nigg
1893 Gunn, Edmund J., Solicitor, Dingwall
1893 Gunn, William Fred., Nutwood, Strathpeffer
1894 Henderson, Alex., Merchant, Dingwall
1893 Johnstone, James, Merchant, Balintore, Fearn
1893 Logan, David, Auchtertyre, Lochalsh
1893 Macdonald, Donald, Wilkhaven, Portmahomack
1893 Macdonald, John, Hilton, Portmahomack
1893 M'Intyre, William, Shettenham, Alness
1893 Mackay, William Wallace, Wester Arboll, Fearn
1893 M'Kenzie, Alexander, Bindal, Portmahomack
1893 Middleton, George, jun., Docharty, Dingwall
1893 Middleton, Thomas, Farness, Invergordon
1893 Middleton, Walter Ross Taylor, Solicitor, Dingwall
1893 Munro, Hector, V.S., Fearn
1893 Paterson, Alex., Ardullie, Dingwall
1894 Robertson-Macleod, K. M., of Greshornish, Isle of Man
1893 Ross, A. M., Editor, 'North Star,' Dingwall
1893 Ross, George A., Rhynie, Fearn
1893 Ross, George, Brompton, Fearn
1893 Ross, Hugh, Banker, Tain
1893 Ross, John, Railway Contractor, Fearn
1893 Simpson, David William, Arcan Mains, Muir of Ord
1893 Watt, Alex., East Ardross, Alness

SUTHERLAND.

1893 Box, John, Tongue, Sutherland
1893 Rose, Alex., Coul, Dornoch

8.—BORDER DISTRICT.

BERWICK.

1893 Bertram, George William, Heughead, Reston
1893 Brown, Robert, Cammo Foundry, Duns
1893 Elliot, Frank, Middlestots, Duns
1893 Galbraith, Chas. E., Ayton Castle, Ayton
1894 Grieve, Andrew, Flass, Lauder
1893 Hogg, George, Blackhouse, Edrom
1893 Johnstone, Robert Fender, Northfield, Coldingham
1893 Logan, Robert, Birkenside, Earlston
1893 Lyall, Alex., Greenknowe, Gordon
1893 M'Dougal, Jas., Eccles Tofts, Greenlaw
1893 M'Dougal, John, Lylestone, Lauder
1893 Mackay, John, Wyndhead, Lauder
1893 Murray, James, Brockholes, Grant's House
1893 Robertson, James Crawfurd, West Mains, Coldstream
1893 Shaw, Alex. Wallace, Skaithmuir, Coldstream
1894 Turnbull, George Gillon, Abbey St Bathans, Grant's House

PEEBLES.

1893 Macpherson, Donald, Edderston, Peebles

ROXBURGH.

1893 Minto, the Earl of, Minto House, Hawick
1893 Clark, John Gay, Mossburnford, Jedburgh
1893 Douglas, Captain Edward Palmer, of Cavers, Hawick
1893 Elliot, John, Hindhope, Jedburgh
1893 Elliot, Thomas, Attonburn, Kelso
1893 Elliot, Thomas Robert Barnewall, yr. of Clifton Park, Kelso
1893 Forsyth, Robert, New Smailholm, Kelso
1893 Hall, William P., Hassendean Bank, Hawick
1893 Henderson, J. Graham, Weensworth Mill, Hawick
1893 Kennedy, Daniel, Littledeanlees, Jedburgh

1893 Madder, James William, Taughill, Bowden, Mertoun, St Boswells
1893 Mather, R. J. (Laing & Mather), Kelso
1893 Oliver, Captain William James, Hoselaw, Kelso
1893 Paton, E. D., Sintonparkhead, Hawick
1893 Robertson, James, Ladyrigg, Kelso
1893 Routledge, Richard, Gorrenberry, Newcastleton
1894 Scott, John, Newton, Hawick
1893 Smith, James, of Olivebank, St Boswells
1894 Steele, John, Branxholme, Hawick
1893 Taylor, William, Ashybank, Hawick
1893 Watson, Robert F., Briery Yards, Hawick

SELKIRK.

1893 Cochrane, Walter, Leynahurst, Galashiels
1893 Purdon, Finlay, Fushielaw, Selkirk
1893 Roberts, George, Whitelee, Galashiels
1893 White, S., Caddonlee, Galashiels

ENGLAND.

1893 Anderton, Geo. Herbert, Kelpin Lodge, Howden, Yorks
1893 Blackstone, Edward Christopher (Blackstone & Co., Limited), Stamford
1894 Carlisle, Countess of, Naworth, Brampton, Cumberland
1893 Clarke, Thomas, Rudchester, Wylam-on-Tyne
1893 Crow, Philip Mansfield, Howden, Yorks
1894 Davidson, William, Tithe Hill, Cornhill-on-Tweed
1894 Dixon, T., jun., Leadhill, Stocksfield-on-Tyne
1893 Irwin, Major T. A., Lynehow, Carlisle
1893 Jones, C. B., Dolgelly, North Wales—*Free Life Member*
1893 Kouger, Alf. Eugene, Goodrington House, Paignton, South Devon
1893 Nimmo, William, Castle Eden, Co. Durham
1893 Powell, J. E., Cambrian Iron Works, Wrexham
1893 Scott, Robert, Wyndham Hotel, Bootle, Liverpool
1893 Spencer, Sanders, Holywell Manor, St Ives, Hunts
1894 Tait, Richard E., Newbigging, Norham on Tweed

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